Comprehensive Program to Manage Energy, Water, and Other Utility Use for State Agencies and State Institutions of Higher Learning

A Report to

Governor Roy Cooper

Pursuant to Executive Order No. 80, Section 8

And

The Joint Legislative Energy Policy Commission,

Joint Legislative Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division

Pursuant to GS 143-64.12(j)

December 1, 2021

Prepared by:

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Preface:

This report contains the Department of Environmental Quality's status update to the North Carolina General Assembly and Governor Cooper for the Comprehensive Energy, Water, and Utility Use Conservation Program pursuant to G.S. 143-64.12(j) and Executive Order No. 80, Section 8.

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List of Acronyms

Abbreviation	Definition
BAS	Building Automation System
Btu	British Thermal Unit
DEQ	Department of Environmental Quality (formerly DENR)
DHHS	Department of Health & Human Services
DIT	Department of Information Technology
DMVA	Department of Military & Veterans Affairs
DNCR	Department of Natural & Cultural Resources
DOA	Department of Administration
DOC	Department of Commerce
DOI	Department of Insurance
DOJ	Department of Justice
DOR	Department of Revenue
DOT	Department of Transportation
DPI	Department of Public Instruction
DPS	Department of Public Safety
ECM	Energy Conservation Measure
EO80	Executive Order 80
ESCO	Energy Service Company
EUI	Energy Use Intensity
FCAP	Facility Condition Assessment Program

Abbreviation	Definition
FY	Fiscal Year
GESC	Guaranteed Energy Savings Contract
GHG	Greenhouse Gases
GS	General Statute
Gsf	Gross Square Foot
HB	House Bill
HVAC	Heating, ventilation, & air conditioning
kW	Kilowatt
kWh	Kilowatt Hour
LED	Light Emitting Diode
LGC	Local Government Commission
MM	Million
$MTCO_{2e}$	Metric Tons of Carbon Dioxide Equivalent
NCCCS	North Carolina Community College System
OSBM	Office of State Budget & Management
SB	Senate Bill
SEO	State Energy Office
SL	Session Law
UNC	University of North Carolina
USI	Utility Savings Initiative

1.0 Executive Summary

North Carolina General Statute (GS) §143-64.12 requires the State Energy Office (SEO) to develop a comprehensive program to manage energy, water, and other utility use for state agencies and state institutions of higher learning. The statute further requires all state-owned buildings to reduce energy usage intensity (EUI)[1] by 30% of fiscal year (FY) 2002-03 levels by 2015. On October 29, 2018, Governor Cooper issued Executive Order No. 80 (EO80) which requires a 40% FY2002-03 EUI reduction by 2025.

As part of these mandates, the Utility Savings Initiative (USI) within the SEO annually collects utility consumption reports from state agencies, University of North Carolina (UNC) System schools and affiliates, and community colleges. The data collected from these governmental units is utilized to generate a report that describes the Comprehensive Energy, Water, and Utility Use Conservation Program (i.e., the "Comprehensive Program") along with a summary of efficiency gains as required every odd numbered year by statute. Additionally, in accordance with EO80, an annual status update is required for each cabinet agency's utility consumption, costs, and progress in reducing energy consumption. The purpose of this report is to meet both statutory and EO80 requirements by summarizing the collective progress of state-owned buildings towards the 40% reduction goal. This report also includes recommendations for further actions that may be accomplished to meet the EO80 goal for state buildings.

Before moving forward, USI needs to clarify that last year's report contained a methodology error that granted the UNC system a 48% reduction in EUI when compared to the FY2002-03 baseline. The error was caused by inadvertently omitting steam and chilled water efficiency factors for UNC System schools and constituent institutions for FY2018-19 and FY2019-20. This resulted in a collective shortage of nearly 3.4 trillion Btus which artificially inflated the total EUI reduction for this sector. After reviewing and updating the methodology, USI found that the UNC System should have had a 37% reduction in EUI in last year's report. These findings were discovered when the Coronavirus Disease of 2019 (COVID-19) pandemic provided an opportunity for USI to focus on data quality and innovation. As such, this allowed time for staff to update methodologies, develop new data collection processes, and apply robust quality assurance practices with automated tools. In addition, USI implemented a new policy of locking historical data so governmental units may only make data adjustments to prior FYs with USI's consent and a valid justification.

<u>State-Owned Buildings Energy Use Intensity Reductions to Date</u>
Accounting for all state-owned buildings includes utility consumption by cabinet agencies, other state agencies, and the University of North Carolina (UNC) System.[2] Collectively, for FY2020-21, all state-owned buildings attained an overall 31% reduction in EUI from the 2002-03 baseline. This is within the range of achieving the EO80 goal by 2025; however, all sectors have more improvements to make. Table 1 *(on the next page)* summarizes EUI reductions to date for cabinet agencies, other agencies, the UNC System, and the combined total for all state

[1] *Represents energy consumption per gross square foot (Btu/gsf)*
[2] *Excludes leased buildings whose utility bills are not paid by state governmental entities.*

governmental units. This data shows that more energy conservation measures are needed by all sectors in order to achieve the EO80 40% EUI reduction goal by 2025.

Table 1: State Government Buildings Energy Efficiency Gains (FY03-FY21)

Participant		Cabinet Agencies	Other Agencies	UNC System	State Governmental Units Total
Gross Square Footage	**% Change**	+23%	+23%	+63%	**+46%**
Energy Usage Intensity (Btu/square feet)	**% Change**	-23%	-4%	-36%	**-31%**

Within state governmental units, the UNC system is a major contributor since they account for 68% of all energy consumed, 65% of the total gross square footage, and 68% of all utility spending. Fortunately, they have also proven to be the pinnacle of energy management considering that the UNC system currently shows a 36% reduction in EUI from the 2002-03 baseline. This accomplishment occurred despite increasing square footage by +63% over the same timeframe. Many UNC System constituents have designated full-time energy managers or energy management teams that consistently review bills, make energy retrofits, take advantage of federal or state funding opportunities, and plan for future initiatives. Such practices resulted in annual utility savings of over $137 million; and cumulatively, have avoided nearly $1.32 billion in utility costs since the Comprehensive Program began. These avoided utility costs represent the amount that would have been paid if energy efficiency retrofits or upgrades were not implemented. The UNC system sets an example for all state agencies; therefore, the utility management plans of the highest performing UNC System schools should be assessed to obtain insight into additional conservation measures that may be implemented.

The remaining totals for state governmental units consists of State agencies. They represent approximately 32% of all energy consumed, 35% of total state-owned square footage, and 32% of total state-owned utility spending. Since FY2002-03, agencies have avoided approximately $270 million in utility costs while their gross square footage has increased by +23%. Despite the lower rate of increasing square footage, agencies have not achieved EUI reductions as high as the UNC System. For example, cabinet agencies and other agencies have achieved a 23% and 4% reduction in EUI since FY2002-03, respectively. This shows that state agencies must improve their energy conservation efforts to contribute relative to their size and energy usage levels. While smaller contributors, other agencies should achieve higher reductions since their conservation efforts still impact the collective state-owned building EUI. This report will recommend definitive steps that these agencies can make to achieve greater reductions in energy usage and costs.

While USI has collected annual utility consumption and cost data from community colleges since FY2007-08, their progress is not included in state-owned building metrics since they are considered local governmental units. This should not devalue their contributions since community colleges represent 32 million gross square feet and $43 million in annual utility spending. Since their unique 2007-08 baseline, community colleges have achieved a 20% EUI reduction despite a +44% square footage increase. In addition, they have avoided over

$91 million in utility costs through implemented energy conservation measures. To further environmental stewardship and management of local taxpayer dollars, USI recommends that community colleges replicate successful efforts from the UNC System to reduce utility consumption and costs (i.e., hiring full-time energy managers).

Another topic to be discussed in this report is the effect of the pandemic on the energy data. With higher education students and employees working remotely, many state-owned buildings were vacant for most of FY2020-21. While the expectation was that collective energy usage would decrease for all sectors due to the lack of human occupancy, this was not the case for all governmental units. For example, the UNC System and community colleges increased energy consumption by more than 240 billion Btus in FY2020-21. Upon discussions with local energy managers and facilities management, this increase may be attributed to additional outside air concentrations and denser filtration media for heating, ventilation, and air conditioning systems (HVAC). Both were common health and safety measures taken to combat the spread of COVID-19 within buildings.

Cost Savings and Air Pollution Benefits Related to Energy Conservation

While most energy efficiency projects require upfront initial investments, they are accompanied by a great deal of savings and avoided costs in future years. Table 2 summarizes utility costs and avoided costs for cabinet agencies, other state agencies, the UNC System, and a combined total for all state governmental units. Together these sectors spent nearly $300 million on utilities which equates to more than $800,000 per day. Of course, this would have been $161 million higher without the avoided costs. As the data shows, the Comprehensive Program achieved approximately $1.6 billion in savings for North Carolina's taxpayers since the FY2002-03 baseline. Further investments into building efficiency improvements towards the EO80 goal can result in additional millions of dollars in utility savings for all state-owned buildings. True savings may be higher due to rising fuel and electricity costs.

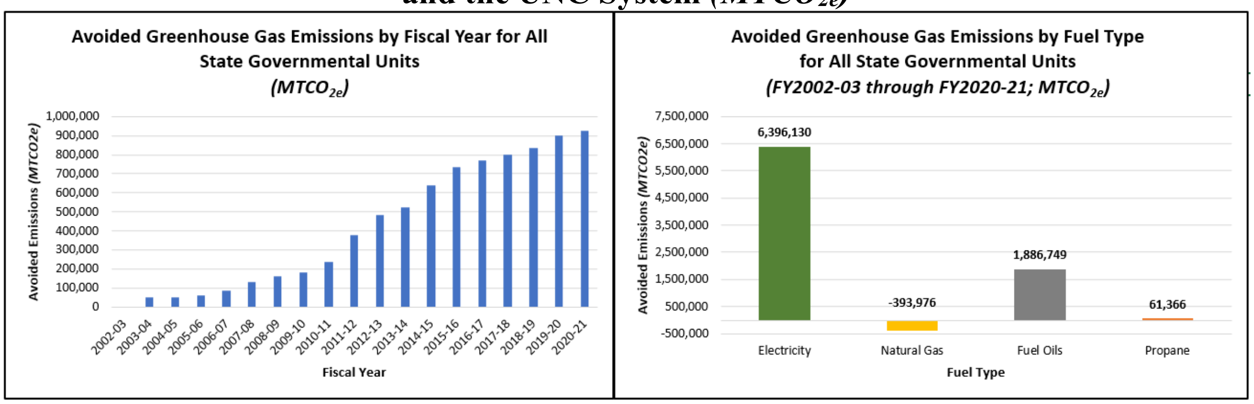
Table 2: State Government Buildings Energy Costs and Cost Savings (FY03-FY21)

Participant	Cabinet Agencies	Other Agencies	UNC System	State Governmental Units Total
Actual Utility Costs in FY21	$90 million	$5.6 million	$204 million	**$300 million**
Avoided Utility Costs in FY21	-$23 million	-$0.7 million	-$138 million	**-$161 million**
Cumulative Avoided Utility Costs (FY03-FY21)	-$260 million	-$10 million	-$1.3 billion	**-$1.6 billion**

Energy efficiency improvements have also provided air pollution benefits by avoiding fuel combustion directly at the buildings or indirectly at central electric power stations. FY2020-21 estimates show that the program avoided 925,456 metric tons of carbon dioxide equivalent ($MTCO_{2e}$)[3] in greenhouse gas (GHG) emissions for state governmental units. Cumulatively since FY2002-03, approximately 7,950,269 $MTCO_{2e}$ of GHGs have been avoided for state governmental units which is equivalent to annual CO_2 emissions from the electricity consumed in 1,444,108 homes or two coal-fired power plants.[4]

Prior to this report, the USI program historically applied one constant kilowatt-hour (kWh) emission factor for all fiscal years based on the most recent *"Emissions & Generation Resource Integrated Database"* (eGRID) data *(see Appendix B for more information)*. However, it was later determined that this methodology was incorrect since the average generation mix changes over time for fossil fuel-fired electricity generating units. As such, the old methodology in addition to the omitted chilled water and steam efficiency factors utilized to derive the previous report significantly underestimated greenhouse gas emissions reductions. A visualization of the corrected values may be found in Figure 1.

Figure 1: Avoided Greenhouse Gas Emissions for State Agencies and the UNC System *($MTCO_{2e}$)*



Recommendations for Collective Action

USI consistently works with all government sectors to identify and to suggest energy efficiency improvements. Some of these improvements are well-defined such as increasing building envelope insulation or converting to LED lighting. Other improvements are more abstract and harder to gain support for implementation. This is where all governmental sectors need to focus in order to achieve greater EUI reductions. Energy efficiency prioritization, reinforcement, and funding are needed from upper management, the Governor's Office, and the legislature to meet the energy reduction goal. A prudent step would be integrating the EO80 directive into statute to provide more legislative authority regarding this work. In addition, shifting the focus towards broad energy management concepts will help ensure energy efficiency becomes a cultural change with long-term commitments. This includes concepts such as the following:

- Designating full-time energy managers
- Investing in automated data collection, reporting, and analysis system

[3] *$MTCO_{2e}$ is metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential. Carbon dioxide equivalents are commonly expressed as "metric tons of carbon dioxide equivalents ($MTCO_{2e}$)."*
[4] *See Appendix D for sources and assumptions used in calculating greenhouse gas amounts.*

- Considering alternative strategies for financing of energy projects
- Utilizing Guaranteed Energy Savings Contracts
- Ensuring the content in utility management plans meets USI's best practices
- Establishing a mandate against purchasing non-LED lamps or fixtures
- Evaluating whether to opt in or out of electric utility rebate programs
- Applying for federal grant funding opportunities
- Extending energy efficiency efforts to leased properties

To understand how operational and cultural changes are effective and that the EO80 goal is achievable, state agencies and community colleges can employ several methods used by the UNC System to reduce energy intensity. The UNC System utilizes full time energy managers, takes advantage of performance contracting, improves building controls, converts to LED lighting, looks for rebate opportunities, etc. They also continue to promote and seek energy efficiency even in small measures. The same initiatives can be used by all governmental sectors.

In summary, the EO80 goal is achievable in 3 years through advanced energy planning. State and UNC System leadership must make the necessary changes in project priority, energy manager support, and energy program funding. The remainder of this report's narrative provides the effects of COVID-19 on energy and water usage; background on the USI program; reporting requirements under GS 143-64.12 and EO80; recommendations for all governmental units to further reduce energy consumption; best practices for leased facilities; and lighting recommendations. Additionally, the appendices to this report contain: (A) detailed agency-specific energy performance data; (B) sources and assumptions used to calculate greenhouse gas offsets; (C) utility management plans; (D) the text of EO80; (E) statutory authority; and (F) suggested revisions to general law.

2.0 Effects of COVID-19 on Energy and Water Usage

During FY2019-20, only three months of utility use and cost data were affected by remote work during the COVID-19 pandemic. As such, the limited amount of pandemic data provided minimal insight into whether usage and costs would significantly change over a full FY. In theory, remote work should reduce energy use requirements; however, this was not the case since health and safety measures utilized to combat COVID-19 generally increased energy usage for buildings. For example, one recommendation was to increase the influx of outside air to heating and air-conditioned building spaces to at least the minimum rates based on applicable codes and standards.[5] When increased amounts of outside air are brought into a building, energy is required to condition that whole volume of air to the desired temperature. This requires significantly more energy than recirculating existing air that had already been conditioned inside the building. Another recommendation was to increase the filtration level used in heating and air conditioning systems to a Minimum Efficiency Reporting Value of 13. Such filtration levels require more energy to force air through the filter media. Both approaches were commonly adopted in the public sector thereby resulting in increased energy usage; however, this is not a sustainable approach.

[5] https://www.ashrae.org/file%20library/technical%20resources/covid-19/core-recommendations-for-reducing-airborne-infectious-aerosol-exposure.pdf

While maintaining COVID-19 health and safety measures is paramount, the public sector must also be aware of energy usage and continue looking for other approaches. Ultra-violet germicidal irradiation and bipolar ionization are two other technologies which can be implemented without a significant increase in energy usage. The caveat is that they require a larger initial investment. Alternately, working with building schedules can mitigate energy usage with the increased outside air method of cleaning a space. If a room or building is to be occupied, a one hundred percent outside air "flush" for two hours prior and two hours after occupation[6] has proven effective and uses less energy than just flushing the space around the clock. This emphasizes that some compromise of technologies should be sought as opposed to accepting that higher energy use is the cost of combatting COVID-19.

3.0 Background on the USI Program

In February 2002, North Carolina's governor issued an executive order to create the *Commission to Promote Government Efficiency and Savings on State Spending*. At the time, the State was challenged with two sequential years of expenditures exceeding incoming revenue. By July 2002, the Commission recommended the establishment of a Statewide initiative for utility savings. Therefore, on July 17, 2002, North Carolina's Governor issued a memorandum to the Council of State members, Cabinet Secretaries, University of North Carolina (UNC) System president, and UNC Chancellors formally establishing the USI program in the State Energy Office.

Senate Bill 668 (Session Law 2007-546, Section 3.1.(a)) was a landmark bill that ratified the USI's goals, mission, and requirements into statute. The purpose of this action was to permanently promote energy efficiency, eliminate waste, and to reduce utility expenditures in state-owned buildings. The legislation required that State agencies and the UNC system develop and implement a management plan, as well as providing annual updates that are consistent with the USI's Comprehensive Program. In addition, the legislation required that the energy consumption per gross square foot in all state-owned buildings be reduced relative to fiscal year 2003-04 levels as follows: (1) 20% by 2010; and (2) 30% by 2015. Furthermore, community colleges were required to submit an annual written report to the State Energy Office containing utility consumption and costs for review.

Senate Bill 845 (Session Law 2008-198, Section 11.1) revised the base fiscal year for the EUI reduction requirements in state-owned buildings to 2002-03 levels. The base year has remained unchanged since that time.

House Bill 1292 (Session Law 2010-196, Sections 1 and 2) permitted institutions in the UNC system to credit unused General Fund appropriations into the next fiscal year for realized energy savings accrued by implementing energy conservation measures. Of the savings achieved, 60% must be utilized for future energy conservation measures. The savings were designed not to affect the recommended continuation utility budget requirements by the Director of Budget. To receive the credit balance, affected institutions were required to submit annual updates to their utility management plans regarding the use of funds using the criteria in GS §143-64.12(a)(1) through (a)(4). For FY 2020-21, twelve UNC System schools asked to carry forward over $18.6 million in savings and reported spending an additional $17.8 million for new energy efficiency projects.

[6] https://www.ashrae.org/technical-resources/building-readiness

In the last five years, UNC System schools have carried forward more than $31 million in savings. These funds are specifically designated for energy efficiency improvements.

Senate Bill 734 (Session Law 2014-120, Section 55) revised the requirement that state-owned facilities provide updates regarding their utility usage and costs, as well as the implementation of management plans from an annual to a biennial-basis.

In October 2018, Governor Cooper's EO80 (Section 8) built on the statutory requirements in GS §143-64.12(a) by directing cabinet agencies to collectively strive to reduce energy consumption per square foot by at least 40% of fiscal year 2002-03 levels by 2025. The EO required that the DEQ's USI program update the Comprehensive Program with strategies to assist state-owned buildings in reducing energy consumption to meet the EO80 goal. In addition, the USI program was tasked with encouraging and assisting, upon request, the UNC System, K-12 schools, and local governments in reducing energy consumption. To meet the EO80 goals, the EO required that cabinet agencies designate an *"Agency Energy Manager"*, prepare a biennial *"Agency Utility Management Plan"*, submit utility data and progress towards the EO80 goal, and required the USI program to provide an annual progress report to the Governor's Office.

3.1 Roles and Responsibilities of Key Entities

Table 3 provides a breakdown of responsibilities that entities involved with the Comprehensive Program are required to perform with reference to the corresponding legislation or executive order.

Table 3: Roles and Responsibilities of Key Entities

Basis	Responsibility	Reference	Assigned Entity
EO80	Encourage and assist, as requested, higher education institutions, K-12 schools, and local governments in reducing energy consumption per square foot in state-owned buildings by at least 40% from FY 2002-03 levels by 2025.	EO80 Section 1(c) and 8	Cabinet Agencies; DEQ USI
	Designate an Agency Energy Manager that serves as an agency's primary point of contact.	EO80 Section 8(a)	Cabinet Agencies
	Implement strategies to support the energy consumption goal in EO80 and submit an Agency Utility Management Plan to the DEQ's USI program by March 1st of every odd-numbered year. The plan should describe the proposed strategies to reduce energy consumption per square foot in state-owned buildings by at least 40% from FY 2002-03 levels by 2025.	EO80 Section 8(b)	Cabinet Agencies
	Submit an Agency Utility Report to the DEQ's USI program by September 1st of each year. The report should contain the consumption, costs, and progress achieved towards meeting the statutory and EO80 directives.	EO80 Section 8(c)	Cabinet Agencies

Basis	Responsibility	Reference	Assigned Entity
	Assess the adequacy of agency Utility Management Plans and their compliance with EO80. Develop annual report describing the Comprehensive Program and summarize each cabinet agency's utility consumption, costs, and achieved reductions, completed by December 1st.	EO80 Section 8(b) and 8(d)	DEQ USI
GS	Develop and annually-update a Comprehensive Program to manage energy, water, and other utilities for state agencies and institutions of higher learning.	GS §143-64.12(a)	DEQ USI
	Submit a utility management plan consistent with the DEQ USI Comprehensive Program biennially. The plan should address findings or recommendations from the Department of Administration energy audits. In addition, the plan should include supporting strategies to reduce energy per gross square foot by at least 30% from FY 2002-03 levels by 2015.	GS §143-64.12(a) and (b1)	All state Agencies; UNC System
	Submit a biennial written report of utility consumption and costs.	GS §143-64.12(a)	Community Colleges
	Carry out the construction and renovation of facilities to further the energy conservation measures and ensure the use life-cycle cost analyses.	GS §143-64.12(a1)	All state Agencies; UNC System
	Create and implement the policies, procedures, and standards to ensure that state purchasing practices improve efficiency regarding energy, water, and utility usage. The cost of such products should be considered regarding their economic life. Administer the Building Energy Design Guidelines that include energy-use goals and standards, economic assumptions for life-cycle analysis, and other criteria on building systems and technologies. Modify the design criteria for constructing and renovating state buildings and the UNC System to require that a life-cycle cost analysis be conducted in accordance with GS §143-64.15.	GS §143-64.12(b); and GS §143-64.15	DOA
	Identify and recommend low-cost energy conservation maintenance and operating procedures that reduce energy consumption within state-owned buildings as part of the Facility Condition Assessment Program (FCAP). Consult with the DEQ USI program to develop an energy audit and procedure for conducting such audits. Conduct an energy audit for all state agencies and the UNC System every five years. The energy audit should serve as a preliminary energy survey.	GS §143-64.12(b1)	DOA

Basis	Responsibility	Reference	Assigned Entity
GS	Implement recommendations from Department of Administration and maximize the interchangeability and compatibility of energy management equipment components.	GS §143-64.12(b1)	All state Agencies; UNC System
	Conduct detailed system-level energy surveys every five years.	GS §143-64.12(b1)	DEQ USI
	Submit a report of the energy audit required in accordance with GS §143-64.12(b1) to the affected state agency or the UNC System.	GS §143-64.12(b1); and GS §143-64.12(b2)	DOA
	Review each energy audit conducted by the Department of Administration and consult with the affected state agency or the UNC System to incorporate the findings into the management plan required by GS §143-64.12(a).	GS §143-64.12(a); and GS §143-64.12(b2)	DEQ USI
	Identify and recommend facilities of state-agencies or the UNC System that are suitable for either: (1) building commissioning to reduce energy consumption; or (2) guaranteed energy savings contracts pursuant to GS §143-64.17.	GS §143-64.12(h); and GS §143-64.17.	DOA
	Develop a biennial report on the Comprehensive Program to the Joint Legislative Energy Policy Commission; the Oversight Committee on Agriculture and Natural and Economic Resources; and the Fiscal Research Division by December 1st of odd-numbered years. The report should contain the elements set forth in GS §143-64.12(j)(1) through (j)(5)	GS §143-64.12(j)	DEQ USI

4.0 Reporting Requirements

4.1 Comprehensive Program and EO80 Update

GS §143-64.12(a): *"The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for state agencies and state institutions of higher learning and shall update this program annually"*

While GS §143-64.12(a) requires state agencies and the UNC System collectively to meet the goal of a 30% reduction in Btu's per square foot by 2015, some participants have not been able to individually reach the objective. USI will continue to assist them in reaching this goal. Additionally, EO80 established a new objective for state-owned buildings of a -40% EUI by 2025 from a 2002-03 baseline. Each cabinet agency is required to appoint an Energy Manager to oversee the collection and reporting of utility data and development and implementation of the agency utility management plan in accordance with GS §143-64.12(a) and EO80, Section 8. The plans should include robust strategies that support statutory requirements and executive initiatives to reduce energy consumption in state-owned buildings.

The USI program prepares a biennial Comprehensive Program report that tracks annual utility consumption and progress towards EUI reduction goals of the reporting entities. USI performs individual site visits to detail best practices and works to maintain savings already achieved by governmental units. Obtaining the mandated EUI reduction objectives will help improve the value of the State's infrastructure, increase the cumulative avoided utility costs, and reduce environmental pollution associated with fuel and electrical consumption.

Below are three primary focus areas of the Comprehensive Program managed by the USI:

Best Practices & Training

Site visits by the USI team remain the cornerstone of support to local and state government facility managers. USI provides preliminary energy audits, project evaluations, and implementation strategy assistance. USI also reviews utility bills and encourages participants to engage in current programs to reduce energy consumption. A core component of the USI program provides relevant energy efficiency training to local and state government facility managers. This training includes the Energy Management Diploma series (through North Carolina State University's Office of Professional Development), the creation of a utility management plan, analyses of utility bills, and conducting classes on building systems and programs to increase efficiency. USI encourages engagement of community user groups and stakeholders along with fostering dialogue and sharing of best practices across governmental units.

Cost Estimates & Financial Options

USI assists state and local government building owners with developing cost estimates and prioritizing energy saving projects. Once project scopes are established, USI can then assist with recommending various types of funding mechanisms based on the situation. These often include equipment rebates, federal or state grants, tax incentives, Guaranteed Energy Savings Contracts (GESCs), and an assortment of utility provider programs. In addition, USI can review project proposals to ensure they best fit the needs of governmental units. On a more granular level, USI will review utility bills to look for saving opportunities such as rate classification changes or peak shaving. USI continuously seeks additional resources to expand energy efficiency programs within state and local government buildings.

Reporting Requirements

The USI team updates and submits reports on the Comprehensive Program, EO80 Section 8, GESCs, HB1292 credits, and utility management plans to stakeholders to provide a status update of key successes.

4.2 Overview of Utility Use and Efficiency Gains for all State Governmental Units and Community Colleges

GS §143-64.12(j)(1): [The report shall contain:] *"A comprehensive overview of how state agencies and state institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains."*

EO80 Section 8: "*DEQ shall develop an annual report that describes the Comprehensive Program and summarizes each cabinet agency's utility consumption, utility costs, and achieved reductions in energy consumption. DEQ shall complete this report for publication on its website and for the Council to submit to the Governor by February 1, 2019, and annually thereafter beginning December 1, 2019.*"

The following tables provide a collective summary of energy and water reduction progress for the UNC system, state agencies, and community colleges. Agency-specific data is provided in Appendix A.

Table 4: State Agency and State Institutions of Higher Learning Efficiency Gains

State Agency and State Institutions of Higher Learning Efficiency Gains		Cabinet Agencies	Other Agencies	UNC System	State Governmental Units Combined Total
Gross Square Footage	Baseline 2002-03 (MMgsf)	36	3.9	56	95
	Current 2020-21 (MMgsf)	44	4.8	91	139
	% Change	+23%	+23%	+63%	**+46%**
EUI	Baseline 2002-03 (Btu/gsf)	127,077	52,089	169,521	148,850
	Current 2020-21 (Btu/gsf)	97,703	50,153	107,939	102,720
	% Change	-23%	-4%	-36%	**-31%**
Water	Baseline 2002-03 (gal/gsf)	61	20	50	53
	Current 2020-21 (gal/gsf)	53	13	19	29
	% Change	-13%	-35%	-62%	**-44%**

Energy Consumption and Savings Highlights from Table 4.

- EUI (Btu/gsf)
  - The Cabinet Agencies are at a -23% reduction from baseline
  - Other Agencies are at a -4% reduction
  - UNC System is at a -36% reduction
  - Total combined state-owned buildings are at a -31% reduction

- Change in Square Footage and Water Usage
  - Total combined state-owned building area has increased by +46% compared to baseline
  - Total combined water usage has decreased by -44% from the baseline

Figure 2: Utility Cost for All Governmental Units

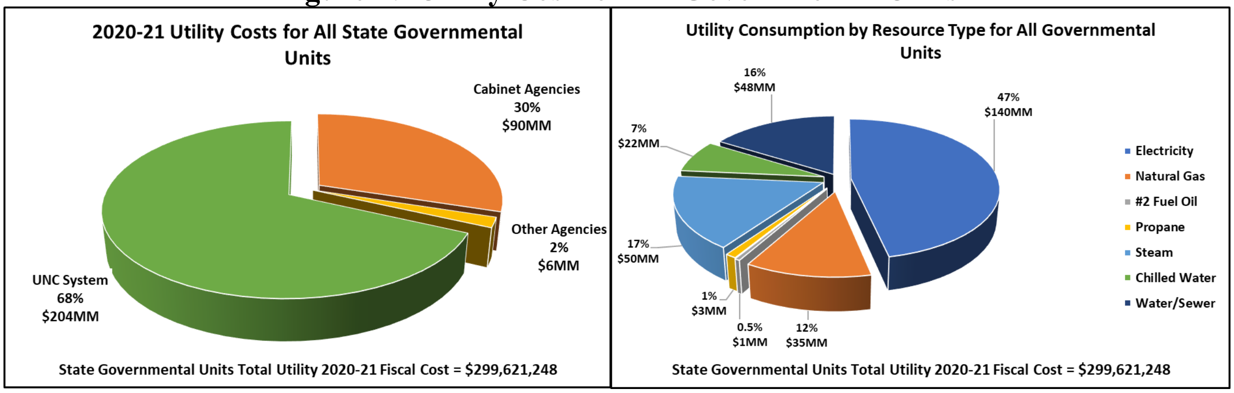
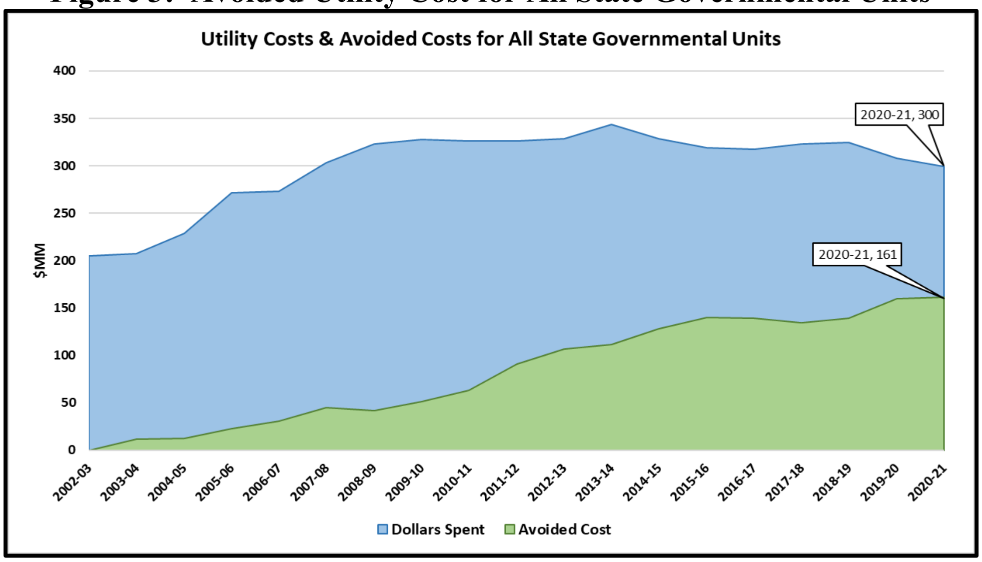


Figure 3: Avoided Utility Cost for All State Governmental Units



Utility Cost Highlights ***(See Table 2 in the Executive Summary Section)***

- Avoided Utility Cost
  - Approximately $161 million in avoided utility costs in FY2020-21.
  - Approximately $1.6 billion avoided in utility costs since FY2002-03.

- Expenditures
  - Approximately $300 million in utility costs (electricity, fuels, and water) for all agencies and the UNC system combined. Over two thirds of this amount is paid by the UNC System.
  - Overall spending was $8.7 million less than the FY2019-20 fiscal year.

UNC System

In 2011-12, a discussion started at Appalachian State to put together an Energy Summit for UNC System members to talk about EUI reduction and sustainability. With the UNC System Office on board, this started a system wide initiative with the objectives to educate students to be leaders of tomorrow, reduce and stabilize the UNC System energy expenditures, transform North Carolina's economy, position colleagues to be national leaders, and to create a culture of environmental and economic sustainability.

The UNC System and its affiliates continue to work hard to be at the forefront when the State Energy Office talks about success in energy efficiency. With the encouragement of EO80, the UNC System has pursued the challenge to reduce their EUI by 40% of FY-2002-03 levels by 2025. This goal was already being discussed and some of the UNC System were pushing towards this goal without EO80. This year's 2020-21 annual consumption reports for the UNC System shows that they continue to be on track to achieve the 40% reduction goal by 2025. The UNC System has reached another goal of over $1.3 billion in avoided costs between 2002-03 to 2020-21. The UNC System has attained these goals while continuing to add new faculty, staff, students, and facilities. The leading universities have energy management teams that consistently reinvest in efficiency projects. By the UNC System continuing to make energy improvements and building efficient buildings, they can handle events that cause utility bills to fluctuate. These include items such as changes in weather, occupancy, hours of operation, and utility rate increases. Their energy stewardship has assisted with reducing the severity of such events on their overall utility consumption and costs. Most importantly, the UNC System can demonstrate how well their energy program is working as they continue to grow.

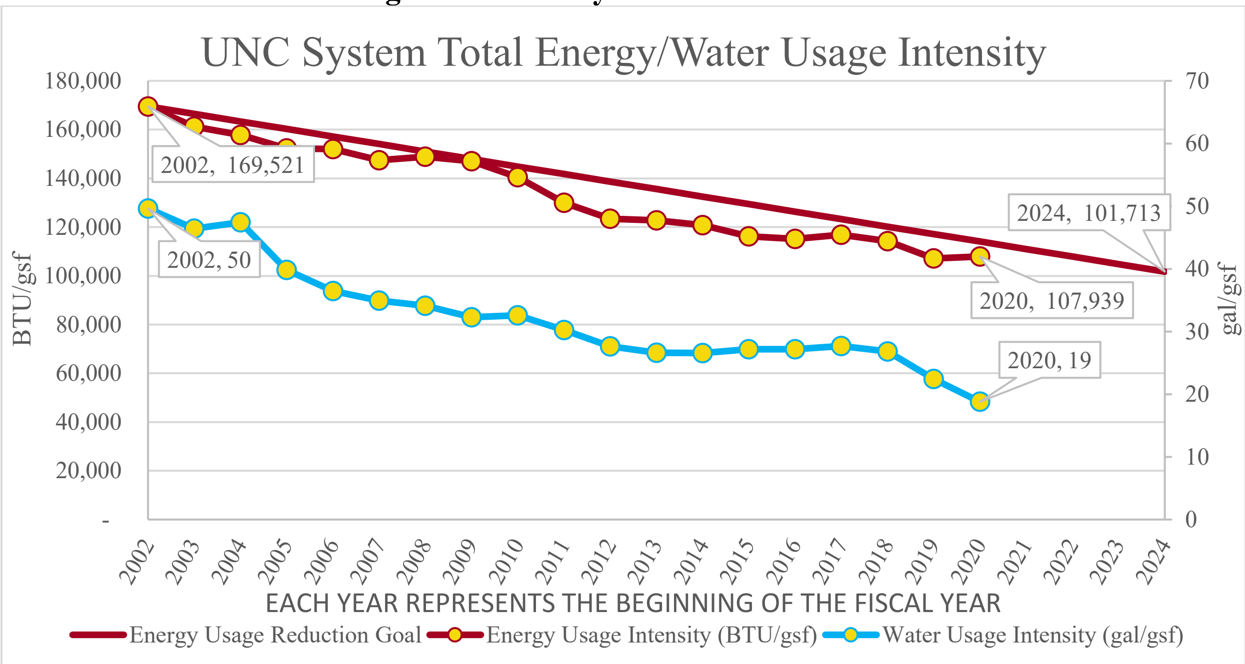
Through the Summit, the UNC System has emphasized that knowledge sharing is crucial for energy management success. They have worked to break down communication "silos" to guide others to become more efficient. USI continues to use the UNC System as the model for energy efficiency. When asked, the UNC System is always ready to educate and assist other entities and sectors.

Table 5 shows the UNC System summary. Square footage has increased by +63% while utility costs have increased by +53%. The UNC System EUI reduction is at -36%. Also, water usage has decreased by -62%, which is significant considering water costs have increased by +202% over the same timeframe.

Table 5: UNC System Utility Statistics To Date

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	55,853,886	90,773,179	**+63%**
Total Utility Cost	$133,416,627	$204,321,350	**+53%**
Energy Usage (Btu/gsf)	169,521	107,939	**-36%**
Energy Cost ($/MMBtu)	$12.98	$18.86	**+45%**
Water Usage (gal/gsf)	50	19	**-62%**
Water Cost ($/kgal)	$3.79	$11.45	**+202%**

Figure 4: UNC System EUI Over Time



Cabinet Agencies

As required by January 15, 2019, all the cabinet agencies have appointed an energy manager to oversee the agency efforts in achieving the EO80 goal. DPS was the only agency that already had a dedicated energy manager; however, all other newly designated energy managers continue to have other full-time jobs/responsibilities that distract from energy management. With the total dollar amount that most state agencies spend on utilities, the lack of a full-time commitment or dedicated energy management staff have proven to be a factor in agencies not moving toward the established reduction goals more quickly. This emphasizes that state agencies spend approximately $95 million dollars per year on utilities which could be reduced with more effective energy management. DPS, DHHS, DOT, DOA, and DNCR are the five largest agencies in the consumption of utilities making up almost 98% of the cabinet agency expenditures for FY2020-21.

Many of the agencies could benefit from pursuing Guaranteed Energy Saving Contracts (GESC) to quickly implement the necessary energy conservation measures. There are currently 23 very successful projects within state governmental units. For example, during FY2020-21, DNCR and DPS started GESC projects to reduce energy consumption. At the time of this report, DNCR is beginning the IGA phase and DPS has completed the facility walkthrough ahead of bid submission from the ESCOs.

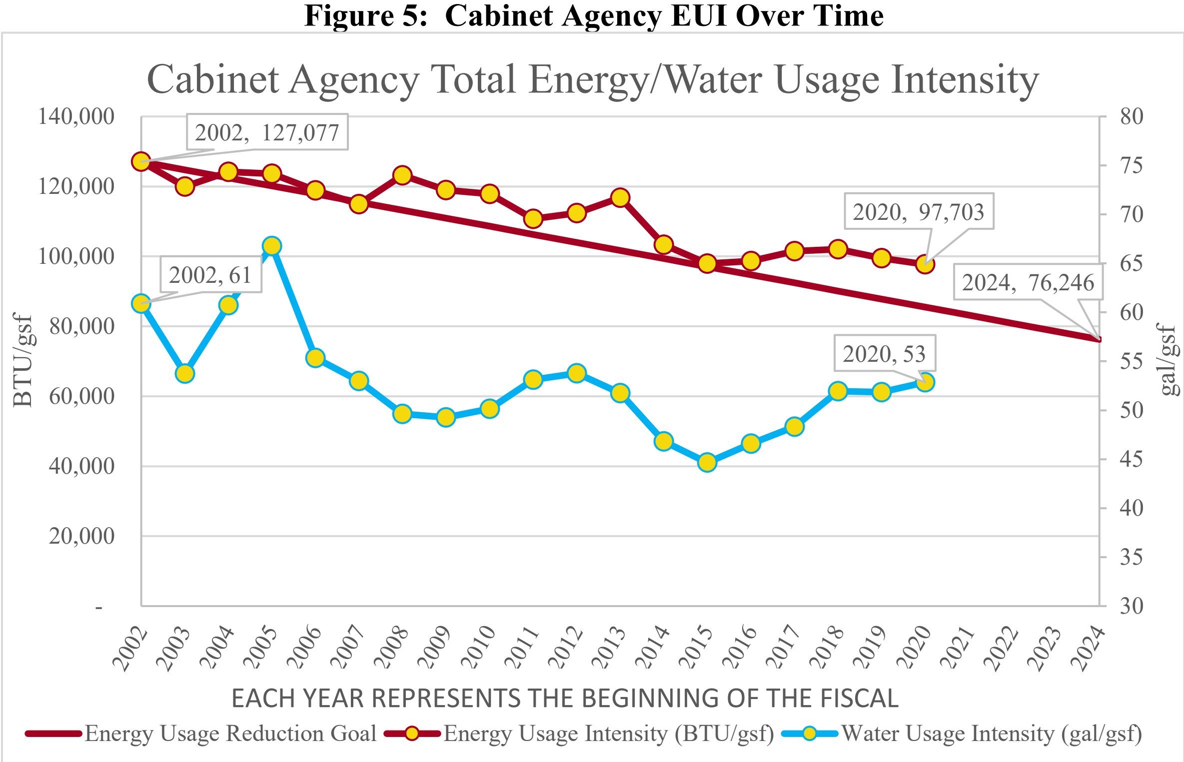
Discounted for many years is the substantial amount of deferred maintenance, outdated equipment, antiquated technology, aging infrastructure, limited staff and most importantly, the financial resources required to make major comprehensive energy improvements. Many cabinet agencies provided funding requests to address some of these energy related needs, but more resources must be allocated to address the many years of neglect if they are to reach the EO80 goal. Cabinet agencies are investing limited resources, as available, to move to LED lighting, provide staff education, and to identify additional low- and no-cost energy conservation measures. The State Energy Office along with the cabinet agency energy managers are working together on this effort.

Table 6 shows the cabinet agency summary. Square footage has increased by +23% while utility costs have increased by +31%. The combined cabinet agency EUI reduction is at -23%. Water usage has decreased by -13% while water costs have increased by +101%. More detailed information about individual agencies may be found in Appendix A.

Table 6: Cabinet Agencies Utility Statistics To Date

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	35,639,940	43,867,011	**+23%**
Total Utility Cost	$68,529,275	$89,672,930	**+31%**
Energy Usage (Btu/gsf)	127,077	97,703	**-23%**
Energy Cost ($/MMBtu)	$12.26	$14.43	**+18%**
Water Usage (gal/gsf)	61	53	**-13%**
Water Cost ($/kgal)	$5.98	$12.01	**+101%**

Figure 5: Cabinet Agency EUI Over Time



Other Agencies

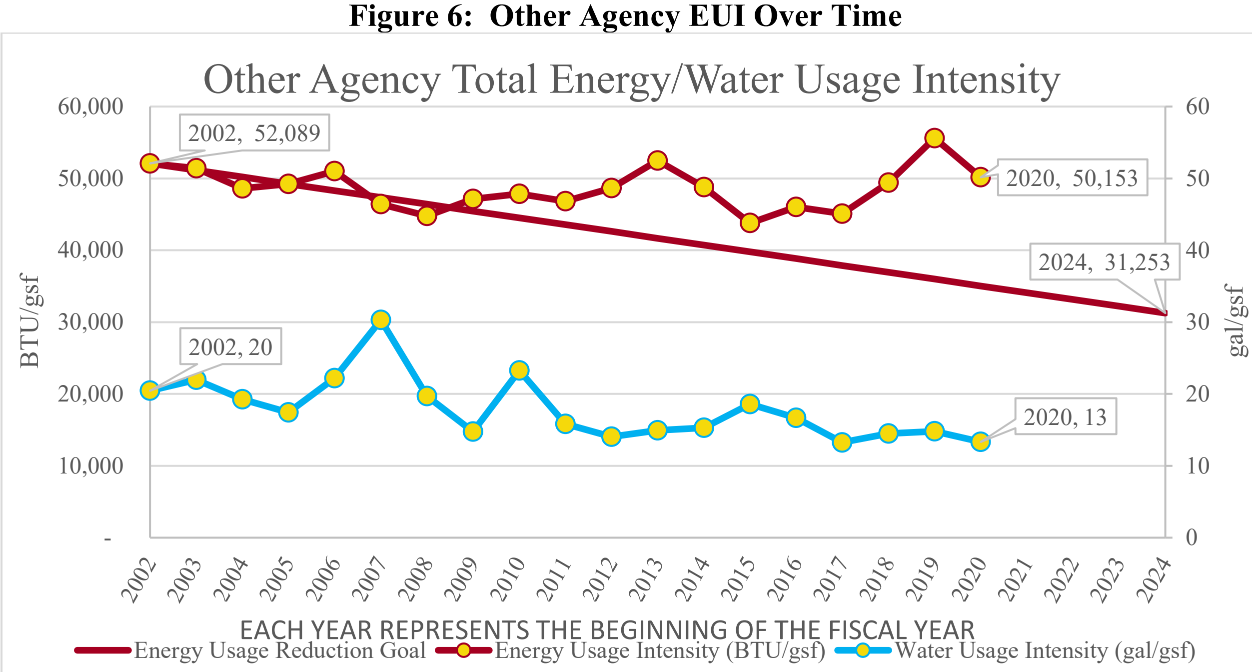
While EO80 applies directly to the cabinet agencies, other state agencies are strongly encouraged to adopt the same -40% EUI goal from FY2002-03 levels. Such agencies include the Department of Agriculture and Consumer Services, the Department of Justice, the Department of Public Instruction, and the Division of Wildlife Resources. Although these agencies were not required under EO80 to appoint an energy manager, they would benefit from hiring dedicated energy managers. This would be a decisive step towards improving their current -4% EUI from the baseline. More conservation and efficiency efforts from these agencies would contribute towards the collective state-owned building energy reduction calculation and help with achieving the EO80 goal.

Table 7 shows the summary for these other state agencies. Square footage has increased by +23% while utility costs have increased by +66%. The combined other agency EUI reduction is at -4%. Water usage has decreased by -35% while water costs have increased by +190%.

Table 7: Other Agencies Utility Statistics To Date

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	3,912,815	4,826,166	**+23%**
Total Utility Cost	$3,391,431	$5,626,969	**+66%**
Energy Usage (Btu/gsf)	52,089	50,153	**-4%**
Energy Cost ($/MMBtu)	$14.75	$19.60	**+33%**
Water Usage (gal/gsf)	20	13	**-35%**
Water Cost ($/kgal)	$4.82	$14.00	**+190%**

Figure 6: Other Agency EUI Over Time



Community Colleges

The North Carolina Community College System (NCCCS) is a key resource to provide accessible educational opportunities and to maximize student success. Since 2007-08, the NCCCS has been submitting annual utility consumption to the SEO. USI continues to meet several times a year with various community colleges to help identify energy efficiency projects and data collection issues. USI site visits are designed to assist with the development of utility management plans, to provide detailed understanding of the annual consumption reports, and to share best practices and successful EUI reduction strategies from other colleges. USI is often asked to guest lecture and to provide energy savings presentations to NCCCS faculty, staff, and students. There are two groups within the NCCCS that continue to address energy savings opportunities: the Association of Community College Business Officers (ACCBO) and the Association of Community College Facilities Operations (ACCFO). Both groups have annual meetings that USI attends and delivers an annual update. These annual meetings allow for open sharing of information, discussions on facility/financial issues and successes across the system. This allows the NCCCS schools to assist each other in overcoming obstacles and with establishing networks for future collaboration. USI's attendance at these events continues to build relationships and often allows USI to meet new staff. During this past year, USI received annual utility consumption reports from all 58 community colleges.

Table 8 shows the community college summary. Square footage has increased by +44% while utility costs have increased by +19%. The combined community college EUI is at -20%. Water usage has decreased by -56% while water costs have increased by +124%.

Table 8: Community College Utility Statistics to Date

Metric	Fiscal Year 2007-08	Fiscal Year 2020-21	% Change
Total Gross Square Feet	22,409,739	32,256,684	**+44%**
Total Utility Cost	$36,524,544	$43,415,862	**+19%**
Energy Usage (Btu/gsf)	78,998	63,269	**-20%**
Energy Cost ($/MMBtu)	$19.17	$19.46	**+1%**
Water Usage (gal/gsf)	14	6	**-56%**
Water Cost ($/kgal)	$7.97	$17.89	**+124%**

Figure 7: Utility Consumption by Resource Type for Community Colleges

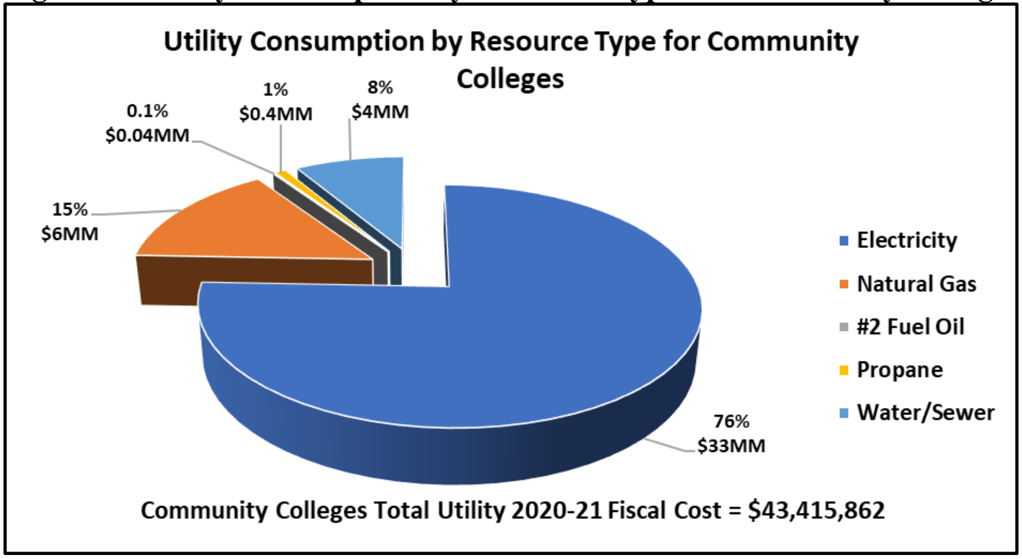
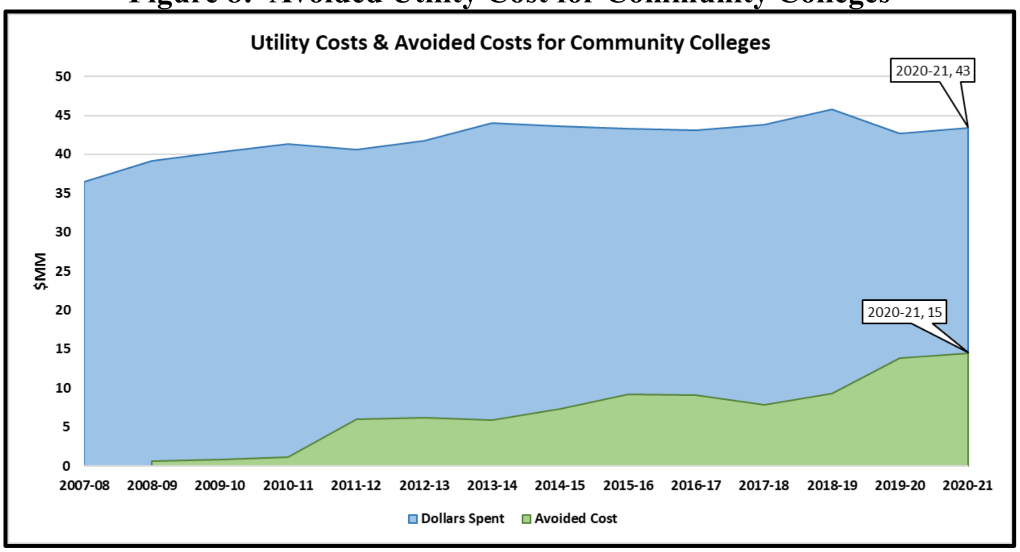


Figure 8: Avoided Utility Cost for Community Colleges



4.3 Suggested Revisions to General Law

GS §143-64.12(j)(2): [The report shall contain:] *"Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed."*

Section 5.0 of this report contains more detail regarding new measures that may be implemented to achieve greater efficiency gains to fulfil the first set of requirements contained in GS 143-64.12(j)(2). As a high-level summary, USI recommends prioritizing energy efficiency for new construction; optimizing aging energy assets; obtaining dedicated full-time energy managers; implementing robust data collection systems; and pursuing unique funding methods.

For the second set of requirements contained in GS143-64.12(j)(2), Appendix F contains suggested revisions that would update EUI reduction requirements, revise applicability for written utility reports, and clarify reporting procedures. Below is a justification for the suggested revisions:

Energy Reduction Goals

State-owned buildings may achieve greater efficiency gains and cost savings if GS 143-64.12(a) were updated to incorporate the EO80, Section 8, goal of reducing EUI by 40% of FY2002-03 levels by 2025. As the analytical data in this report shows, the 2025 target year is achievable by developing robust planning strategies, prioritized investments, and innovative mindsets to leverage existing resources that may further reduce energy consumption and costs. The USI program supports updating the energy reduction requirements since they would provide additional environmental benefits and reduced energy costs for future generations.

Reporting Intervals

In the past, state governmental units were statutorily required to report annual energy, water, and other utility use to the USI program. This allowed USI's staff to efficiently locate abnormalities, provide best practices, and suggest measures to reduce energy consumption and costs. Unfortunately, Session Law 2014-120 changed this reporting requirement to a biennial-basis which created difficulties for USI's staff to obtain robust data to assist governmental units with energy management. The USI program supports reinstating the annual requirement for governmental units to provide a written report of energy, water, and other utility use in GS 143-64.12(a). In addition, under the same provision, the program supports clarifying that utility reports are to be submitted by state agencies, institutions of higher learning, and community colleges by September 1st of each year.

Criteria for Utility Management Plans

According to the United States Department of Energy, utility management plans are intended to clearly articulate goals that reduce waste, support environmental stewardship, and provide monetary savings to taxpayers[7]. The USI program supports revising the provisions of NCGS 143-64.12(a)(1) – (a)(5) to incorporate the minimum best practices for energy management success based on staff experience and federal guidance. The suggested provisions are expected to provide clarity and the foundation to build forward-looking and structured plans of how to achieve energy goals over two-year intervals.

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[7] https://www.energy.gov/sites/prod/files/2014/05/f15/cesp_guide.pdf

4.4 Summary of Management Plans and Energy Audits

GS §143-64.12(j)(3) – (j)(5): [The report shall contain:] *"A summary of the state agency and state institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section... a list of the state agencies and state institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the state agencies and state institutions of higher learning that received an energy audit...*

Utility management plans are a necessary tool in helping governmental units achieve energy reductions. Significant planning and effort must be invested long before energy conservation measures can be realized. Projects require ownership, coordination, approvals, and funding. In order to achieve the EO80 goal by 2025, state governmental units should have a defined path and plan. However, many of the utility management plans received are not straightforward and vary in quality. Some provide minimal guidance as to how the state governmental units intend to meet the energy efficiency goals while others lack clear strategies, objectives, or identification of funding resources to be allocated by the state governmental units. Several plans do not specify dates, responsibilities, or assignments for specific individuals/departments to ensure that the tasks are completed, and energy efficiency is achieved. Without forecasting how energy dollars are to be allocated to efficiency projects, limited funding resources often are not aligned with energy goals. Furthermore, these plans are often not the collaboration of an interagency group, but the work of specific individuals. Without broader input, the plan becomes narrowly focused and frequently results in increased facilities maintenance workload. Leadership endorsement and participation is required for the plans to be successful. Acknowledgement and support of energy priorities must be communicated to the whole organization. Without all these elements, the plans often fail to achieve stated goals.

Therefore, USI has developed a list of best practices for utility management plans. A well-written plan should contain the following items:

1. Utility Reports with consumption and costs, and efficiency gains
2. Specific projects, strategies and responsibilities for achieving the goals
3. Assignment and authority of overall energy management success
4. Training of staff to communicate plan objectives
5. Financing options for funding energy savings projects
6. Signature page that shows upper management acknowledgement

Table 9 *(on the next page)* summarizes the governmental units that did and did not submit utility management plans for inclusion in this report.

Table 9: Utility Management Plans Submitted

Agencies	Submitted Plan	
	Yes	No
Department of Administration	X	
Department of Commerce	X	
Department of Environmental Quality	X	
Department of Health and Human Services	X	
Department of Information Technology	X	
Department of Military and Veterans Affairs	X	
Department of Natural and Cultural Resources	X	
Department of Public Safety	X	
Department of Revenue	X	
Department of Transportation	X	
Other State Agencies	**Submitted Plan**	
	Yes	**No**
Department of Agriculture and Customer Services	X	
Department of Justice	X	
Department of Public Instruction		X
NC Wildlife Resources Commission	X	
University of North Carolina System	**Submitted Plan**	
	Yes	**No**
Appalachian State University	X	
East Carolina University	X	
Elizabeth City State University		X
Fayetteville State University	X	
North Carolina A&T University		X
North Carolina Central University		X
North Carolina School of Science and Mathematics	X	
North Carolina State University	X	
The North Carolina Arboretum		X
University of North Carolina at Charlotte	X	
UNC Hospitals	X	
University of North Carolina School of the Arts	X	
UNC System Office	X	
UNC TV	X	
University of North Carolina Asheville	X	
University of North Carolina Chapel Hill	X	
University of North Carolina Greensboro	X	
University of North Carolina at Pembroke	X	
University of North Carolina Wilmington	X	
Western Carolina University	X	
Winston-Salem State University	X	

The following energy conservation measures were most frequently mentioned as those that are being implemented in most facilities:

Light Emitting Diode (LED) Lighting: LED lighting technology is growing exponentially while costs have decreased. LED area lighting improves safety, dramatically reduces maintenance requirements/costs and has a high return on investment. Maintenance staff are embracing LED lighting because this technology significantly reduces maintenance requirements. For example, such fixtures may require little to no maintenance over a period of 10 to 20 years.

Building Automation System (BAS): BAS improvements or installation continues to be needed in most facilities. Building automation is the centralized control of a building's HVAC, lighting, and other systems. This control is achieved through a building management system (BMS) or a BAS. The purpose of building automation is to improve occupant comfort, to improve the efficiency of building systems, to identify maintenance issues and to reduce energy consumption and operating costs. A centralized system also takes the control out of the hands of multiple occupants, which provides improved energy savings and helps prevent 24/7 operation by allowing both occupied and unoccupied set points.

Equipment Replacement: Energy consuming equipment replacement as related to HVAC, chillers, and water heating (i.e., boilers) is increasing, primarily driven by the age of the equipment. Most facilities have been diligent in trying to maintain existing equipment, but as staff resources dwindle, this only reduces the life expectancy of this energy consuming equipment. Many facilities need extensive amounts of new equipment and improvements to aging infrastructure that supports this machinery.

Submetering: Metering and the increased ability to measure energy usage of buildings is needed. Energy metering and environmental monitoring provide valuable information regarding how buildings are performing. While this energy conservation measure does not technically provide energy savings, energy metering can help identify cost-cutting opportunities by detecting inefficiencies. Submetering is required to be able to benchmark each building and to help identify buildings that are out of line and where excessive energy usage needs to be addressed.

Employee Engagement: Energy awareness across campuses continues to be highlighted in almost all plans. Energy awareness helps define the governmental unit's energy mission and goals by establishing a direct relationship between saving energy and success in meeting these goals, all while assessing the constraints and opportunities within a facility. Evaluation of energy use patterns based on the types of equipment, size of staff, hours of operation, and current levels of energy use ensure obtainable goals are delivered and determine activities well-suited to the organization's planned needs. Upper management support endorses the program's messages while energy awareness uses various communications channels and program capability to produce printed materials, displays, videos, and handouts to drive this awareness.

Governmental units are contending with competing priorities and other primary responsibilities along with limited resources and staff to identify energy efficiency projects. Requests were made to expand financial resources so that identified energy projects can be performed. Prioritization and reinforcements are needed from within the governmental unit and the governor's office for the

EO80 goal to be achieved. The mission of each governmental unit is critical, and what has been discounted for years is the substantial amount of deferred maintenance, outdated equipment, antiquated technology, aging infrastructure, limited staff and most importantly, the financial resources required to make major comprehensive energy improvements. The State Energy Office, along with the governmental unit energy managers, are working together on this effort. Energy savings must be elevated in importance within each governmental unit's daily responsibilities.

Per G.S. 143-64.12(j), the State Energy Office must report on the energy audits being completed through the State Construction Office's Facility Condition Assessment Program (FCAP). The FCAP reports focus on five deficiency areas for buildings: ADA, Critical, Energy, Life Safety, and Targeted Renovation. It is required by statute to include energy savings opportunities that require little or no expenditure of funds in the Energy section of these reports. Upon discussions with DOA, it was revealed that FCAP does not conduct detailed energy audits due to resource and expertise limitations. Because of this, USI was unable to successfully list the recipients of energy audits as required per statute in this report. However, DOA did provide a list of low-to-no-cost energy conservation measures that they recommend in the FCAP program. A few of these ECMs are included below:

1. Removal of personal appliances
2. Reduce water use for irrigation
3. Upgrade lighting to LEDs
4. Regular maintenance of HVAC equipment
5. Maximize use of building automation systems

5.0 Recommendations for All Governmental Units to Further Reduce Energy Consumption

In addition to achieving continued reductions in existing buildings' energy and water use, new buildings must be constructed to energy efficiency standards. As new buildings are constructed, governmental units have greater ability to operate and to monitor building performance thereby ensuring energy efficiency goals are met. Sectors that have ageing buildings and infrastructure continue to experience difficulties in optimizing building operations and with monitoring energy usage. Transitioning from old, out of date technology to new technology and systems better enables buildings to meet energy goals. These improvements will also improve building comfort and indoor air quality. USI continues to recognize achievements and promotes best practices through programmatic and legislative means. The following are key areas to be addressed.

5.1 Energy Program Management

Dedicated Energy Manager

Every successful energy program must have a champion. That is a person who is fully committed to and consistently works to further the program goals. An energy manager serves this role, and the importance cannot be overstated. A full-time, dedicated energy manager is an important asset and can recover energy savings and costs that exceed their salary multiple times. As such, USI has advocated for several years that every agency, university, and community college hire at least one full-time, dedicated energy manger. The UNC system has adopted this philosophy as evidenced by the fact that most UNC system universities currently employ at least one full-time energy manager, and several have whole dedicated energy management teams. As a result, the UNC system leads all public sectors in reducing their energy consumption from baseline levels. The UNC EUI is currently at -36% which exceeds state agencies by -14% and community colleges by -16%. Governor Cooper also recognized the importance of energy managers and directed through EO80 that all cabinet agencies appoint energy managers. While energy managers are needed, most state agencies complied by appointing an existing employee who already had another full-time position. Energy management was added as an additional duty on top of the employee's existing workload. Without being able to dedicate full-time efforts, these employees are not able to be as effective nor achieve the energy efficiency results a full-time energy manager could. DPS is the only state agency who currently has full-time, dedicated energy managers. During FY2020-21, DHHS committed in their utility management plan to hire an energy manager. The remaining agencies will hopefully follow their leadership. Similarly, energy managers are inconsistently placed within the community college system. Some of the larger, more advanced colleges have energy managers, but the majority do not have a champion in this position.

Once a full-time energy manager is hired, other factors must also be considered in order to help this position succeed. First, leadership must prioritize the need for energy efficiency goals to be met within the organization. When upper management prioritizes and supports the importance of energy conservation, the rest of the organization will respond accordingly. This sets the tone and expectation for everyone to participate. Second, the energy manager must be positioned strategically within the organization. They are typically located within a facilities department but have close ties to the business office. That is because they need to know about the equipment and building projects being planned but also be aware of budgets and utility spending. Every project from a stand-alone HVAC package unit to new building construction should be reviewed by the energy manager. Third, they should have the authority to influence and direct these projects for the selection of energy efficient equipment and other energy conservation design considerations. This involvement helps to ensure that a complete life cycle cost is weighed against the upfront costs. Often equipment which might be the cheapest to purchase will cost more in operation over the long run. Fourth, the energy manager should have a dedicated source of funding to implement conservation measures. Ideally, documented savings from energy efficiency measures can be tracked and those funds returned so that additional measures can be implemented. In this manner, the overall savings begins to grow and cascades as an organization becomes more efficient. That is a key indicator of a successful energy management program.

Utility Data Collection

Once an energy manager is hired, utility data is an essential part of their energy management program. Utility data is the key to determining which buildings are the highest energy users, which utilities cost the most, where conservation efforts should be focused, have savings been achieved, and whether are leaks occurring. Without data providing measurements of utility usage, an energy manager is working without guidance and cannot properly manage the energy usage of an organization. However, some organizations receive thousands of utility bills from a multitude of providers every month. Merely collecting and compiling all these bills into a usable format can be an arduous task that subtracts from the goal and active work of managing energy. That's why several organizations have turned to third party data collection services to manage and to provide data from all their utility bills. This third party collects, verifies, reconciles, and records all bills so that the energy manager can access the data with ease. Formatted reports are available with up-to-date information so that energy managers can track utility usage from month to month and analyze fluctuations which can signal potential issues. This type of regular and consistent analysis is imperative to understanding and managing the utility consumption for an organization. Luckily, this is an area which saw much success over the past year. During FY2020-21, several cabinet agencies (DOA, DHHS, DOT, and DNCR) have committed to improved utility data collection and should soon start using this data to produce efficiency results.

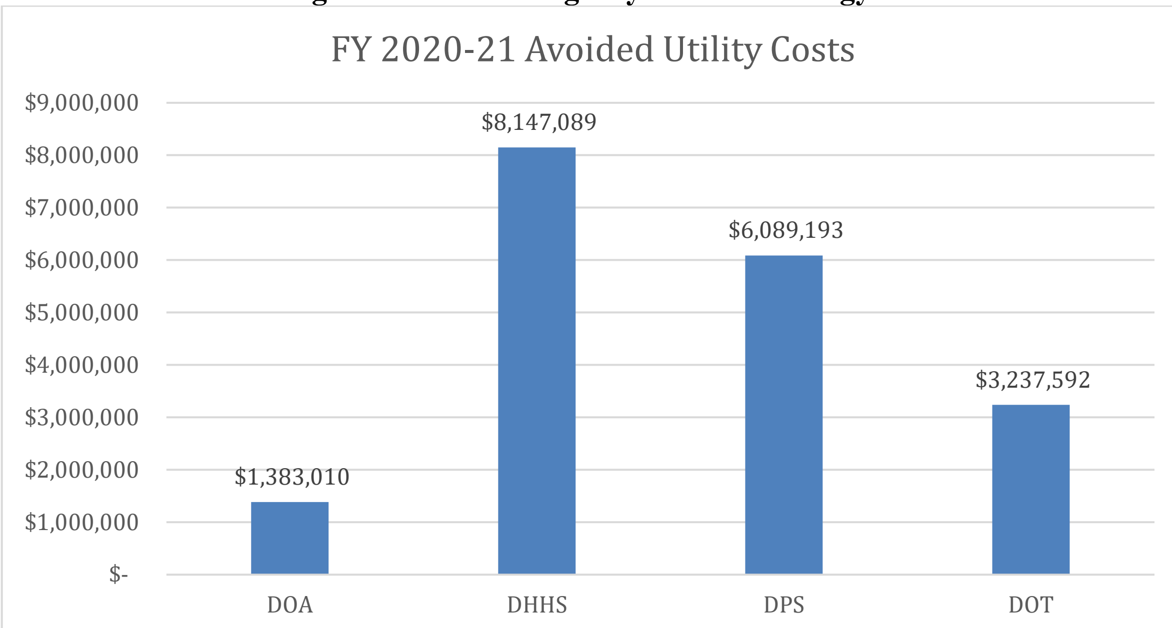
5.2 Funding Methods

Energy Savings Credits

One barrier all governmental energy programs face is a lack of funding for efficiency improvement projects. In this regard, the UNC System and affiliates benefit from a statutory provision that was created under HB 1292 (SL 2010-196, Sections 1 and 2). This provision allows the UNC System and affiliates to retain funds annually left over in their utility accounts by measuring and verifying energy savings associated with energy saving projects completed during the same fiscal year. These funds are credited into the next fiscal year's budget with the requirement that at least 60% of those funds must be used for more energy related projects. This provides an incentive to install projects which generate energy savings because a portion of the funds are credited back and can then be used for more efficiency projects. Over time, projects become larger thereby resulting in greater savings. By taking advantage of the 1292 credits, the UNC System has received back a total of $31 million dollars in the last five years to reinvest in energy savings projects. In FY2019-20, eleven UNC schools requested credit of $15.2 million. In FY2020-21, twelve UNC schools requested a credit of $18.6 million. That is a significant amount of money that makes progress towards improving energy efficiency within the UNC System and its affiliates.

Upon seeing the efficiency success, the UNC System has achieved with 1292 credits, many state agencies have expressed interest in a similar program to incentivize their efficiency investments. One way to achieve this is through legislative action, but that can be a difficult and lengthy process. As an alternative, DPS and USI have been working with the Office of State Budget and Management (OSBM) to try and determine a methodology that would allow state agencies to recapture energy savings. This is still in the development stage, but the idea is to create a template for agencies to follow. Agencies would work with OSBM to document energy savings and possibly retain those funds within their agency as opposed to the funds reverting to the General Fund. The agency would have to demonstrate that the funds are still available within the existing budget and were not utilized elsewhere. Figure 9 shows the previous fiscal year's estimated avoided energy costs of the top four agencies. If these agencies had a mechanism like HB1292, some of this avoided cost could have been utilized further to fund more energy efficiency projects. Hopefully, next year's report will be able to provide a significant progress update on this effort. In the interim, because of these efforts, state agencies have learned that they are able to capture all funds gained from rebates or utility credits. Upon documenting these funds, OSBM can assist with creating a special cost account just for the rebates and/or credits, and the funding can be used for energy projects.

Figure 9: Cabinet Agency Avoided Energy Costs



Guaranteed Energy Savings Contracts

Since 2002, GS §143-64.17 allows for governmental units to utilize the GESC process to implement and to finance major facility upgrades which save energy and reduce utility expenditures. Under the law, the energy savings resulting from the performance of the contract must equal or exceed the total cost of the contract. Furthermore, the contracts are not to exceed a term of 20 years from the date of the installation and acceptance. Based on the rules in *Title 01 NCAC Subchapter 41B,* an Energy Services Company (ESCO), in collaboration with the affected governmental units works to: (1) design and propose a package of energy conservation measures (ECMs); (2) install the selected ECMs; (3) provide measurement and verification of the annual savings for the duration of the contract; and (4) guarantee the dollar savings of the energy savings. Utility budget savings caused by the implementation of the guaranteed ECMs provides repayment of the multi-year loans executed by governmental units to finance the initial energy upgrades. Governmental units are encouraged to utilize the GESC process to fund capital projects that will assist in meeting the EO80 goal. The USI program's staff are equipped to provide technical assistance and guidance throughout the GESC process.

Three cabinet agencies; DOA, DOT, and DPS have used this method of finance for energy efficiency improvements. DOA has achieved a collective savings of approximately $1.5 million above the guarantee for two projects that ended in FY2020-21. In just four years, DOT has accumulated savings of almost $800 thousand dollars above the guarantee for their two projects, and DPS has saved over $800 thousand dollars above the guarantee for their project. USI is overseeing an additional seventeen projects within the UNC System that have an expected guaranteed savings of over $409 million through the life of the contracts. With the success of these three agency projects, DPS and DNCR have both released RFPs in FY2020-21. The DNCR project includes the North Carolina Zoo, all three aquariums and five museums. The DPS project is for six 1000 cell correctional facilities. All projects to date have seen over $21 million dollars of above guaranteed savings. Agencies and the UNC System have proven that GESC works and works well for completing energy projects. Using a GESC allows state agencies to obtain large-scale improvements in record time, with a single vendor, and with a guaranteed energy savings that is validated by a third-party as required by statute. GESC continues to be a valuable method of funding energy improvement projects and should be utilized to the maximum extent if EO80 agency goals are to be achieved. With only 16% of the state-owned square footage that have taken advantage of this program, not looking at this tool as both a finance and energy efficiency method for any energy efficiency project is short-sighted and narrow.

Duke Energy's Energy Efficiency Opt-In Program

Duke Energy offers an energy efficiency plan for customers to choose whether to "opt-in" and take advantage of energy savings programs. The purpose of these programs is to encourage installation of high efficiency equipment. Participants generally pay a little more on monthly power bills but can then purchase high efficiency equipment or lighting at a reduced price or with rebates. In this manner, Duke Energy incentivizes a portion of the higher cost of energy efficient installations and maintenance activities. Alternately, customers may elect not to participate or "opt-out" of the energy efficiency and/or demand-side management programs and receive a monthly bill credit. Customers are encouraged to use these monthly savings to fund and implement their own efficiency measures. However, one potential issue is that many customers that opt-out do not use their savings for energy efficiency as the program was designed.

Some state agencies have opted-out in order to utilize the funds for their own energy efficiency projects. DOA is considering opting out and specifically using the funds for third-party utility data management. DPS is using the opt-out savings for staffing to manage energy efficiency projects. Both are good ways to utilize the opt-out savings.

Duke Energy's Small Business Energy Saver Program

Duke Energy's Small Business Energy Saver program offers up to 80% savings on energy efficiency improvements for small businesses. This program is available to nonresidential customers with an average annual demand of 180 kilowatts or less. They have a dedicated contractor that performs free energy assessments for potential program participants. From the assessment, recommendations are made based on the business type and operating hours. Overall, savings vary with the combination of recommendations and type of equipment that is replaced. The process is simple since the contractor counts all the light fixtures, calculates the savings/payback, and does the installation. The result is a turnkey project consultation and installation where the participant receives cash rebates to encourage the purchase and installation of high-efficiency lighting, HVAC systems, commercial and agricultural equipment, as well as equipment for industrial and governmental facilities. These rebates are available for both new construction and retrofit of existing or replacement of failed equipment. Duke Energy will also provide consultation services to make sure that a customer is getting the right rebate or incentive. Both DEQ and DPS have used this program successfully to upgrade lighting in a number of facilities within Duke Energy's service territory. DOA has received proposals from the program to upgrade lighting in both the ABC Commission and warehouse. Hopefully, more governmental units will take advantage of this program for some of their energy efficiency upgrades in the future.

Repair and Renovation

Each agency makes annual requests for repair and renovation budgets. These requests contain capital projects, maintenance issues, aging equipment, and infrastructure necessary to maintain the current use of existing facilities. These funds are justified by references found within the FCAP operated by the Office of State Construction. This is a budgetary process that is typically underfunded and continues to increase North Carolina's deferred maintenance issues. While energy efficiency projects may be funded as part of repair and renovation, they must compete against other more critical "life safety" improvements. Designating a percentage of the repair and renovation funds directly for energy efficiency projects would assist with funding energy savings improvements. USI has been working with OSBM to create a monetary set aside specifically for energy efficiency improvements that state-owned buildings could access to fund projects. If the budget allows this action, much needed capital would be provided for energy efficiency improvements.

Federal and State Storm Recovery and Resiliency Funding

A. Building Resilient Infrastructure and Communities (BRIC)

On October 5, 2018, the Disaster Regulatory Reform Act was signed into federal law by the President of the United States. Section 1234 of the Act authorized the Federal Emergency Management Agency (FEMA) to annually set aside 6% of expenses from each Presidentially-declared major disaster declaration to create and fund the BRIC grant program. The BRIC program supersedes the Pre-Disaster Mitigation program and is focused on nationwide hazard mitigation projects. For the 2021-2022 grant cycle, FEMA allocated approximately $1 billion through the BRIC program to fund resilience projects that reduce risk and damage from future natural hazards, are cost effective, meet the latest two consensus codes, are technically feasible, align with the State or Tribal Mitigation Plan, promote equity and inclusion of disadvantaged groups in accordance with the federal "Justice40 Initiative"[8], and meet all environmental and historic preservation requirements. Of that amount, $56 million *(up to $1 million per applicant)* is designated for all states and territories, $25 million is set aside for tribal governments *(up to $1 million per applicant)*, and $919 million is estimated to remain in the national competition after allocations to states, territories, or tribal governments are made *(up to $50,000,000 per sub-applicant)*. All states and territories that have had at least one Presidentially-declared major disaster declaration within the past seven years are eligible unilaterally apply as "applicants" or on behalf of "sub-applicants". For the purposes of North Carolina, the "applicant" is deemed to be the DPS's Division of Emergency Management Division (NCEM), while "sub-applicants" are deemed to be state agencies, local governments, and federally-recognized tribal governments.

The BRIC program emphasizes that successful projects reduce risks to as many of the seven "community lifelines" as possible, promote equity for disadvantaged groups, and incorporate nature-based solutions. The BRIC program also prioritizes projects that enhance resilience while conforming to the latest two consensus building codes, a criterion that challenges North Carolina applications due to the state's adherence to older building code standards. These criteria ensure that projects provide long-term solutions to prepare communities before disasters and will quickly prevent an unforeseen chain of negative events after disasters. The "community lifelines" are critical services that communities use including: (1) safety and security; (2) food and water; (3) shelter; (4) health and medical; (5) energy (power and fuel); (6) transportation; and (7) hazardous

[8] Executive Order 14008; January 27, 2021; https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf

materials. The formation of partnerships with public, private, and non-profit organizations could assist with incorporating several lifelines into project proposals in addition to providing cost-sharing. Projects are graded based on technical *(all or nothing for credit)* and qualitative criteria *(partial credit allowed)* per FEMA's project specifications. For FY 2021-2022, the cost share of projects is generally 75% federal and 25% non-federal. It is important to note that FEMA will pay up to 90% of costs for *"Economically Disadvantaged Rural Communities"* which is defined as an area of less than 3,000 people that earn less than 80% of the national per-capita income[9].

State agencies may be eligible to utilize the BRIC funding opportunity to improve the resiliency and energy efficiency of state-owned infrastructure if key project elements are incorporated into North Carolina's Enhanced Hazard Mitigation Plan (HMP). However, without proactively including key project elements into the HMP, proposals from state agencies may not be eligible to move forward in NCEM's official application to FEMA. The USI program recommends that agencies interested in the BRIC program coordinate with NCEM to identify critical infrastructure or essential functions that may be included in the next HMP update that is due to FEMA by October 2022. These efforts will assist with future funding proposals for the BRIC program to enhance the energy-efficiency and resiliency of state-owned buildings.

B. North Carolina Disaster Recovery Framework (NCDRF)

In 2018, the NCEM established twelve "Recovery Support Functions" (RSFs) as part of the NCDRF to address long-term planning, resiliency, and recovery goals in North Carolina[10]. Each RSF consists of several stakeholders from governmental and non-governmental organizations to provide technical subject-matter support, suggest policies, or request legislation to achieve the framework's goals and mission for future events. As such, the USI program recommends that the energy-efficiency and resiliency of state-owned buildings be explored and prioritized in RSF #5 (Transportation & Infrastructure) to align with the key goals of EO80. These buildings are an area that would greatly benefit from future state-funded opportunities or methodologies to assist with reducing annual energy intensity and costs. While RSF #5 has not met since the last report, future efforts for state-owned buildings could be coordinated through the North Carolina Office of Recovery and Resilience.

6.0 Best Practices for Leased Facilities

As USI continues to collect utility data from reporting entities, the subject of leased spaces remain. The annual report only collects utility data from state-owned buildings while excluding usage related to leased spaces. This decision was made as the reporting requirements were derived in GS 143-64.12. The primary reason is that the occupant of leased facilities lacks control of the type, style, or efficiency of the energy using equipment within leased facilities. Secondly, most agencies lease only minimal space as needed and often for short terms. Over the years, government entities have requested specific requirements for these leased spaces, but energy related requirements have not been part of the prerequisites of those spaces. Often energy efficiency of these spaces was not

[9] Cost Share Requirements, Pre-Award costs and Management Costs; https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/before-apply
[10] *2019 NORTH CAROLINA Disaster Recovery Framework;* https://files.nc.gov/ncdps/documents/files/2019-NC-Disaster-Recovery-Framework-FINAL.pdf

prioritized. With this knowledge, USI has set out to provide this top five list of best practices for leased spaces. These best practices should be requested whenever a leased space is being considered since they will indirectly promote the private sector to increase the efficiency of their buildings to obtain a state contract. Lease renewals are also a good time to negotiate energy efficiency upgrades with building owners.

1. LED Lights

Light Emitting Diode (LED) is now the standard to which all lighting is compared. LEDs are made from non-toxic materials and can last from ten to fifteen years (which is around six times the life of regular bulbs). The price of LED has decreased significantly since they were first introduced while the cost for non-LED lighting increases as those technologies are being phased out. As such, LEDs not only reduce energy but are also now cost efficient. Moreover, studies continue show that improved lighting increases productivity.

2. BAS or Programmable Thermostats with Setbacks

Having the ability to control when and how the HVAC is operated will allow for better system operation and energy savings. These controls provide the ability to set systems back at night and weekends or during times that the facility is unoccupied. Most programmable thermostats have security settings that will lock the setting to prevent tampering. This allows for improved energy savings and control of operation when the building is occupied and when unoccupied.

3. HVAC and Water Heating System Condition

While lessees may not be able to specify new energy efficient HVAC and water heating systems, there should be a requirement that the systems should have been recently commissioned or retro-commissioned. This would include maintenance records and anything else that would prove that the condition of the energy using equipment is at peak performance and is working properly. The property owner should provide a detailed service plan for all equipment to include a regular maintenance schedule.

4. Building Envelope Survey and Repairs

A building envelope survey should be done to assess and document the overall condition of the exterior of the possible lease facility. This survey should include things such as door weather stripping, caulking around windows, and whether energy efficient windows and doors are in place. If possible, this survey should utilize thermo-imaging cameras to detect issues that cannot be seen with the human eye. The shell of the building is constructed only once but stands as the only protection from outdoor conditions. This shell is designed to eliminate the transfer of heat and cold both from the interior and exterior of the building. All efforts to improve building insulation and to repair air leaks will improve the overall efficiency of the building.

5. Energy Policy

Government entities should have an energy policy which covers both leased and owned properties. This policy should address temperature set points, plug load, occupant behavior, personal appliances, and efficiency of equipment within these facilities. The policy provides direction to employees and specifies operational parameters of equipment that can be controlled. Equally important is enforcement of this policy. Without proper enforcement, USI has seen plug loads and negative behaviors become prevalent in state-owned buildings.

7.0 Eliminate Non-LED Lighting

The 2007 Energy Independence and Security Act established guidelines to reduce the wattage of incandescent bulbs, required the removal of magnetic ballasts, and set new standards for linear fluorescent lamps. Since 2007, there has been a continual shift in the market towards the elimination of older outdated lighting technology. In fact, in order to continue allowing the purchase of many of these outdated lamp technologies, manufacturers have creatively changed the names to designer lamps or labeled them as architectural. Meanwhile, prices have steadily climbed, and procurement has become more difficult. Just recently, a major lighting manufacturer announced an additional thirty percent price increase on non-LED lamps and ballasts to be effective in January 2022. This is on top of the price increases that have already taken place over the past decade. The message is clear that continued reliance on outdated lighting technology will result both in high costs from the energy to operate and from the price to purchase replacement bulbs. All state facilities that still use outdated technologies will pass this cost on to taxpayers until lighting upgrades are implemented.

With these increased costs and procurement difficulties, the time has come to move forward with newer LED lighting technologies. LEDs were invented in 1962 and have been around for more than fifty years. Originally as with any new technology, consumers were wary to adopt LEDs due to high prices and skepticism about manufacturer's quality. As a result, a group of utility companies in the northeast formed the Design Lighting Consortium (DLC) to create standards and performance requirements for LEDs. This has become the gold standard for LED lighting, and today, for any utility rebate to be obtained, the lamp or fixture must be DLC certified. This has cemented LED as a proven technology.

Most common linear florescent lamps have a rated wattage of 32 watts whereas the most common LED linear lamps have a rated wattage of only nine watts. When measuring the efficiency of a lamp, the lighting industry uses the term lumens per watt. This shows how much visible light is being delivered for a given amount of electricity. The higher the lumens per watt, the more energy efficient the lamp. A typical florescent 32-watt lamp will have an efficiency of 60 lumens per watt while a typical nine-watt LED lamp will have an efficiency of 110 lumens per watt. A fixture that has four 32-watt florescent lamps uses a total of 128 watts. The same fixture with four nine-watt LED will be using only 36 watts. That's a savings of 92 watts per fixture, and most office buildings have hundreds of fixtures. The math alone should prove that moving to LED is more cost effective on reducing the use of electricity.

Beyond the energy savings, moving to LEDs will have some additional benefits to any facility. Primarily, the longevity of LED lights leads to a drastic reduction in maintenance and labor costs. Secondarily, since new LEDs do not contain mercury like fluorescent bulbs, they are substantially more environmentally friendly. Lastly, LEDs provide better light quality and quantity as compared to older technology. Insufficient or improper lighting can create glares or reflections, making concentration and getting comfortable more difficult for employees. Poor lighting can also create workplace incidents or security risks due to lack of illumination. LED Lighting helps to mitigate all these issues.

At this point, there should be no reluctance to move all lighting away from older technologies; however, non-LED lighting continues to exist within many state-owned buildings. Steps need to be taken to remove and replace all non-LED bulbs and fixtures. At a minimum, state-owned buildings should stop buying inefficient, non-LED lamps and fixtures. That requires a directive against purchasing new non-LED lamps and fixtures unless a written exception is granted. That would be a first step, and then state-owned buildings should begin to phase out all existing old lighting technologies. DPS is leading by example because they have initiated the *"LED in'23"* lighting campaign where their goal is to have every single building outfitted with LED lighting by the end of FY2023-24. Each state-owned building must start now and begin to take the necessary steps to become more energy efficient and environmentally friendly by moving away from inefficient lighting.

8.0 Conclusion

The pandemic and data corrections have had an impact on the collective state-owned building's EUI reduction. However, state-owned buildings are still within range of achieving the EO80 -40% EUI goal by 2025 if significant energy efficiency projects are implemented without further delay. Hiring full-time dedicated energy managers with decision-making authority and access to specific funding for energy improvements would assist substantially in this effort. Management must empower these energy managers and fully support EUI reduction initiatives both with communicating energy efficiency goals and with providing leadership in making sure the goals are achieved. Improved data collection efforts are underway within several state agencies, but all governmental units would benefit from a comprehensive utility data collection system. This would be instrumental in helping energy managers to identify and to address areas of greatest improvement. Similarly, all governmental units need to consider alternative financing mechanisms for energy efficiency projects such as GESCs. A prudent way to schedule energy upgrades is by developing a well-written utility management plan which is another area needing improvement within all sectors. As employees and students return to offices and campuses, utilizing high volumes of outside air for heating and air conditioning systems are not an energy efficient solution for COVID-19 health and safety measures. Other technologies should be considered and building schedules adjusted to flush air from occupied spaces. Also, directives should be implemented to prevent purchasing non-LED lamps or fixtures throughout all government sectors. Energy conservation measures for leased spaces provide an opportunity for all sectors to reduce energy consumption and costs while indirectly promoting the private sector to become more efficient to meet contracting standards.

Overall, state agencies, the UNC system, and community colleges spent over $340MM on utilities last year. Proper stewardship of these funds requires energy conservation measures and a focus on energy efficiency. This message must come directly from leadership and filter through all levels of governmental sectors. Funding is always an issue, but inaction costs more in the long-term due to ever rising utility rates. That is evidenced by the fact that state-owned buildings have avoided almost $1.6 billion dollars in utility costs since FY2002-03. While somewhat intangible, this avoided spending has had a tremendous impact on the state budget to date because that savings freed up funds which could be spent for other purposes. Now, more than ever, a reinvestment in energy efficiency is necessary for North Carolina to continue as a national leader in energy conservation. The USI team is prepared to support and to assist with all these efforts and to drive future energy savings across the state. Everyone must work together to conserve North Carolina's valuable resources.

Appendix A

Agency Summaries, Data, and Graphs

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Department of Administration (DOA)

The Department of Administration acts as the business manager for North Carolina State government. The Department oversees Government Operations, which includes the maintenance of state-owned buildings and grounds. The DOA Division of Facility Management has been tracking electrical and natural gas consumption data for buildings owned and maintained by DOA monthly since 1998. The Division is also responsible for operating and maintaining DOA buildings, including paying the water, electric, and natural gas utility bills. DOA operates a central steam heating plant, two chilled water plants, and chilled water storage tanks. Most large DOA buildings are in the Downtown Government Complex with the majority being offices, but also includes the steam and chilled water plant. The buildings are mostly occupied by agencies other than DOA with DOA serving as landlord. Joe Baden is the energy manager and works in the Facility Condition Assessment Program at the State Construction Office in Raleigh.

Figure 3: DOA EUI

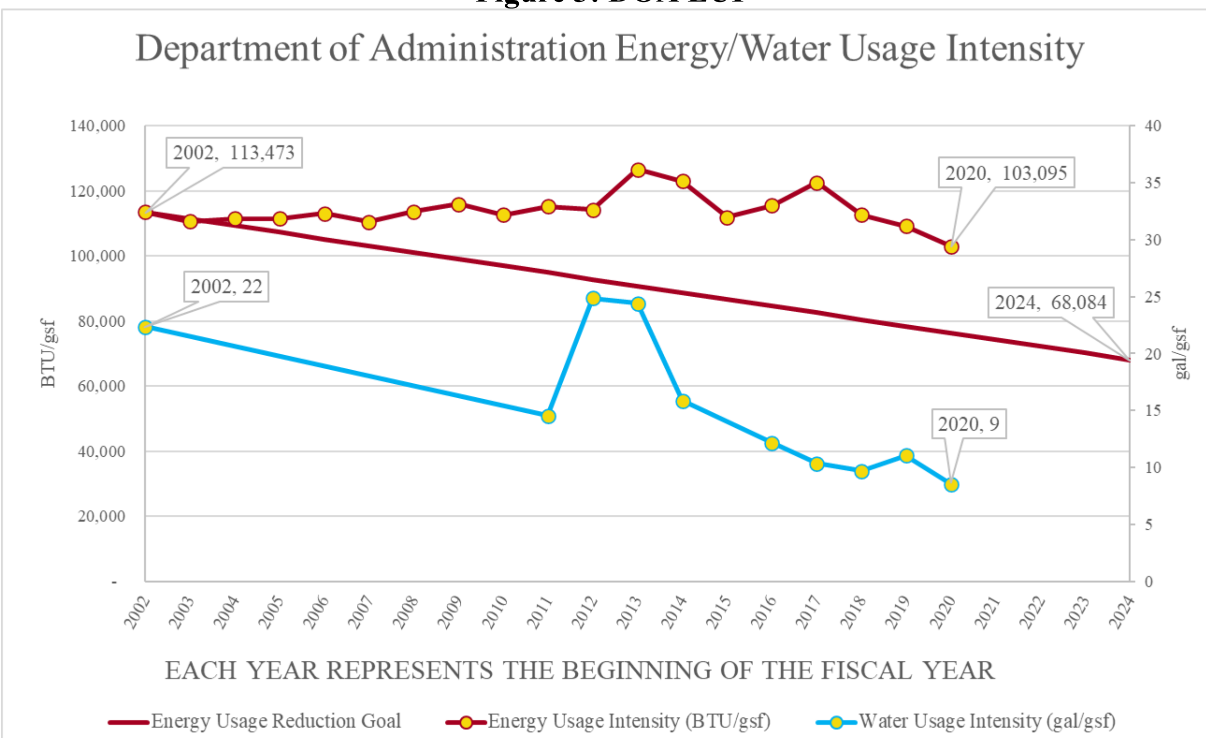

Table 1: DOA Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	6,140,901	4,730,270	-23%
Total Utility Cost	$8,927,218	$6,739,766	-25%
Energy Usage (Btu/gsf)	113,473	103,095	-9%
Energy Cost ($/MMBtu)	$12.37	$12.87	+4%
Water Usage (gal/gsf)	22	9	-62%
Water Cost ($/kgal)	$2.23	$11.50	+417%

Department of Commerce (DOC)

The DOC's mission is to *"work closely with local, regional, national, and international organizations to propel economic, community, and workforce development in the State."* To accomplish this task, the DOC is comprised of several divisions and programs that assist businesses with siting and workforce requirements, connecting the community with funding opportunities to attract new businesses, and publishing analytical reports for those interested in investing in North Carolina's economy. Except for the Division of Employment Security's (DES) Central Office, all business operations are housed in properties that are owned by the Department of Administration (DOA) or leased. Therefore, the DES is the only entity that is required to report utility consumption through the DOC in accordance with GS §143-64.12 and EO80, Section 8. Joe Katzberg who is the Director of Support Services is designated as the energy manager for DES.

Water data for DOC could not be obtained due to a bypass line around the meter that prevents the agency from receiving accurate consumption readings.

Figure 4: DOC EUI

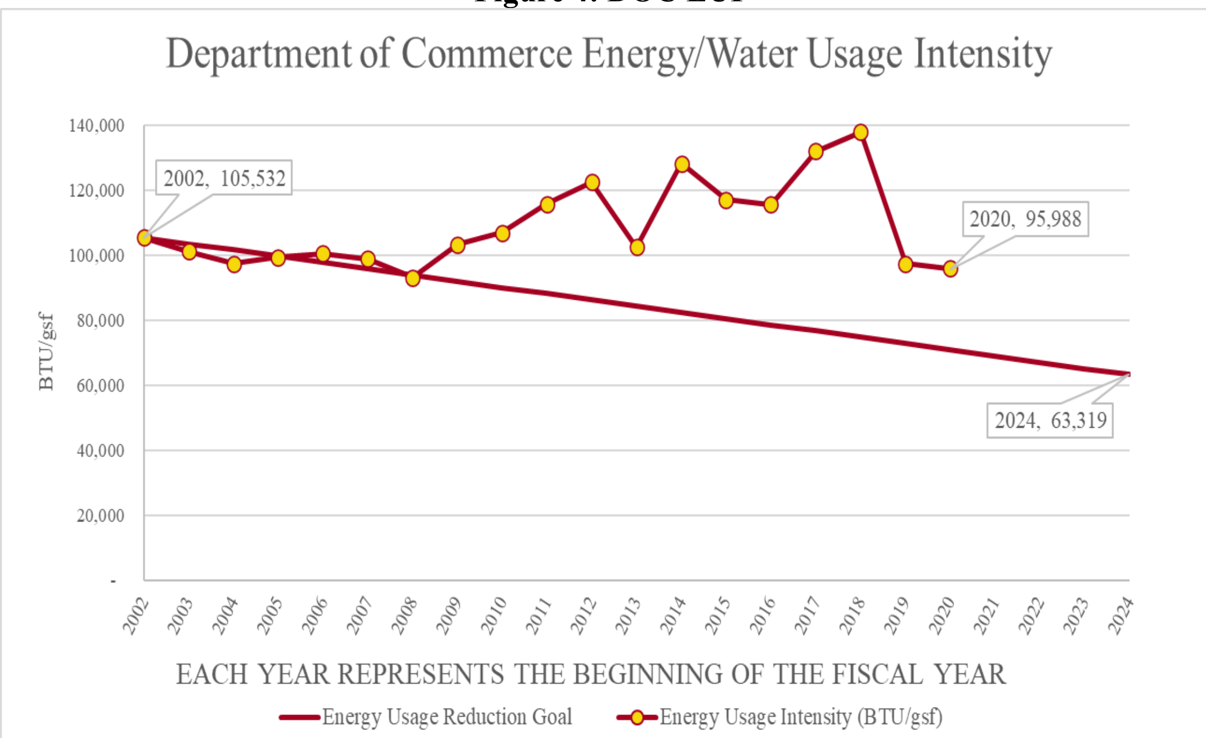

Table 2: DOC Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	261,091	261,091	0%
Total Utility Cost	$398,568	$371,603	-7%
Energy Usage (Btu/gsf)	105,532	95,988	-9%
Energy Cost ($/MMBtu)	$14.47	$13.98	-3%

Department of Environmental Quality (DEQ)

The DEQ is the lead stewardship agency for the protection of North Carolina's environmental resources and has offices from the mountains to the coast. Chief responsibilities include administering regulatory programs designed to protect air quality, water quality, and the public's health along with advancing energy efficiency. The majority of DEQ employees work in buildings owned by the DOA or in leased buildings which are not included in the utility data of this report. Only the state-owned facilities currently managed by DEQ are measured and tracked for the DEQ utility data. These facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. Mr. Eric Turon based in Raleigh is the DEQ Facilities Engineering Manager. 2002-03 baseline data was estimated for DEQ to track EO80 progress, but this exercise could not be done for every year between 2002-03 and 2010-11 due to data availability limitations. Therefore, the figure below begins with DEQ's utility data in the 2010-11 fiscal year.

Figure 5: DEQ EUI

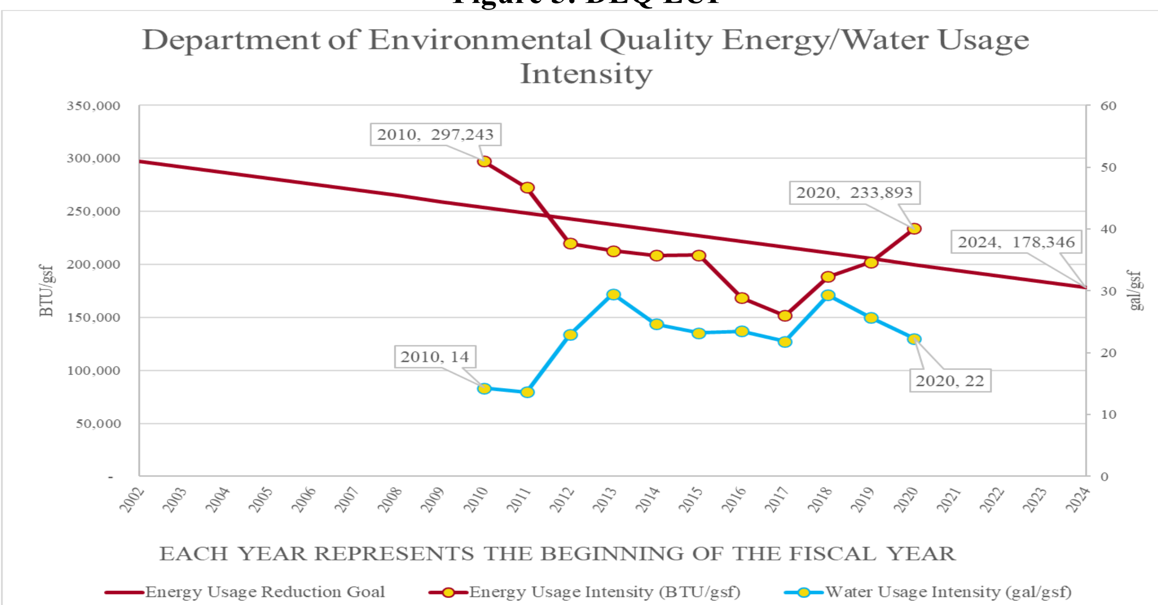

Table 3: DEQ Progress

Metric	**Fiscal Year 2002-03**	**Fiscal Year 2020-21**	**% Change**
Total Gross Square Feet	105,527	99,335	-6%
Total Utility Cost	$572,246	$367,751	-36%
Energy Usage (Btu/gsf)	297,243	233,893	-21%
Energy Cost ($/MMBtu)	$17.56	$14.38	-18%
Water Usage (gal/gsf)	14	22	+56%
Water Cost ($/kgal)	$14.21	$15.14	+7%

Department of Health and Human Services (DHHS)

The DHHS manages the delivery of health and human-related services for all North Carolinians, especially our most vulnerable citizens; children, elderly, disabled and low-income families. The Department works closely with health care professionals, community leaders and advocacy groups; local, State, and federal entities; and many other stakeholders to make this happen. The Department is divided into 30 divisions and offices. DHHS divisions and offices fall under four broad service areas: (1) health; (2) human services; (3) administrative; and (4) support functions. DHHS has approximately 635 buildings at 14 different institutions across the State encompassing roughly 7.6 million square feet of space. These institutions include psychiatric hospitals, neuro-medical treatment centers, alcohol and drug abuse treatment centers, developmental centers, and vocational rehabilitation centers. The Energy Manager for DHHS is Greg Johnson. Mr. Johnson is housed within the Division of Property and Construction where his primary role is as a Building Systems Engineer.

Figure 6: DHHS EUI

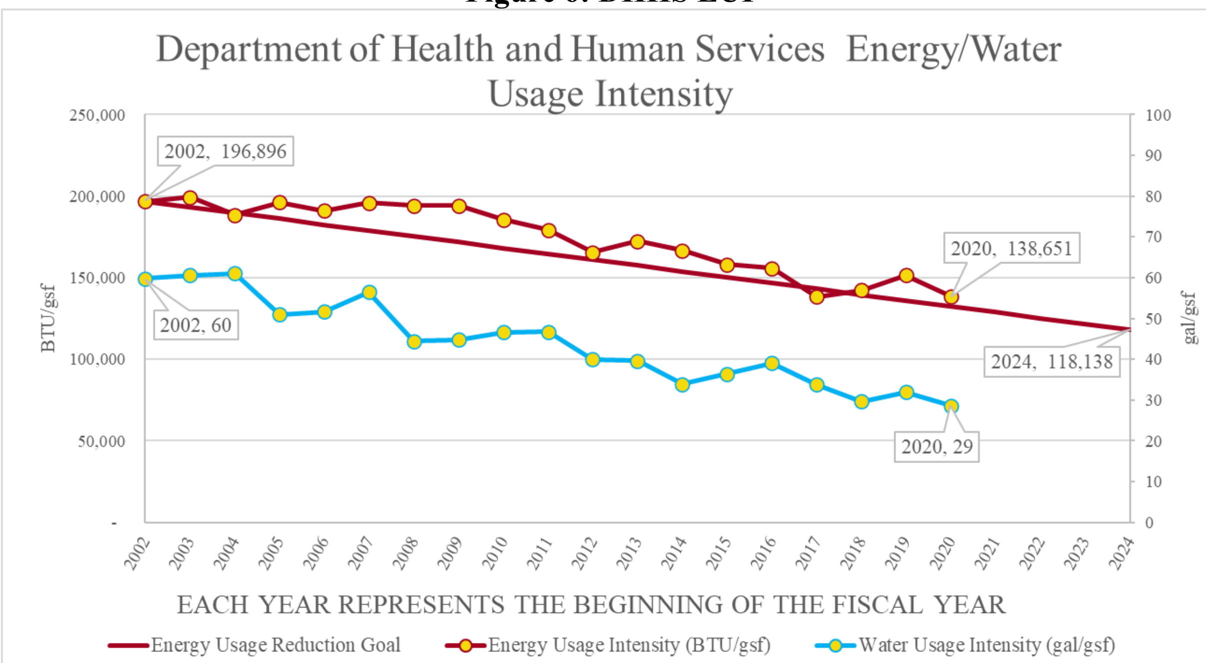

Table 4: DHHS Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	6,381,007	7,879,534	+23%
Total Utility Cost	$12,834,405	$15,380,185	+20%
Energy Usage (Btu/gsf)	196,896	138,651	-30%
Energy Cost ($/MMBtu)	$9.23	$11.77	+28%
Water Usage (gal/gsf)	60	29	-52%
Water Cost ($/kgal)	$3.25	$11.18	+244%

Department of Information Technology (DIT)

The DIT has two data centers totaling almost 150,000 square feet. The Eastern Data Center (EDC) located in Raleigh is nearly 40 years old. The Western Data Center (WDC) located in Forest City is 13 years old. The nature of DIT's Data center facilities differs from most State buildings since their energy consumption is constantly variable depending on the number of servers, network, and other types of information technology (IT) equipment in use at any given time. DIT offers numerous IT services supported by the Data centers to other state agencies. Floor hosted options are also offered to the agencies where they can utilize a spot on the Data floor with a DIT supplied rack, power, and cooling. As state agency's IT requirements change over time, there is a general upward trend in the power consumption needed. The Energy Manager for DIT is Tony Brackett. Mr. Brackett is housed at the WDC location where his primary role is the WDC Facilities Manager.

Figure 7: DIT Progress

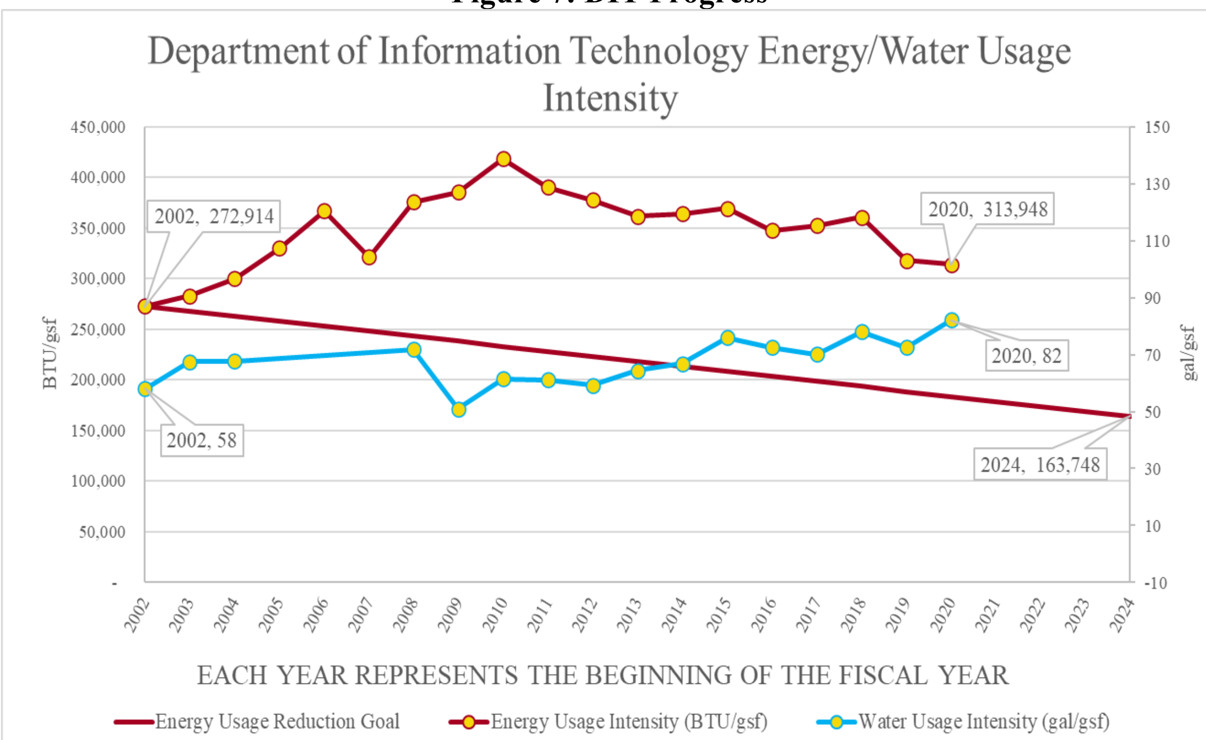

Table 5: DIT Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	94,343	163,866	+74%
Total Utility Cost	$362,255	$1,145,187	+216%
Energy Usage (Btu/gsf)	272,914	313,948	+15%
Energy Cost ($/MMBtu)	$13.67	$19.45	+42%
Water Usage (gal/gsf)	58	82	+42%
Water Cost ($/kgal)	$1.90	$10.75	+466%

Department of Military and Veteran's Affairs (DMVA)

The DMVA is the newest of the State agencies dedicated to helping veterans and active duty men and women access the programs, benefits, and resources that they have earned. DMVA staff are committed to providing the highest level of service, responsiveness, and integrity in keeping the principles and values of this State and nation that military personnel and their families deserve. DMVA assists with the management of four military Skilled Care Nursing Homes housing almost 450 veterans and is in the construction phase of a 120-bed home with plans to build a sixth home. NC has one of the largest military footprints of any State, representing three out of the four branches. Military and defense industries are the second largest employers in our State and the military has an economic impact of over $66 Billion dollars annually. The energy manager is Cecil Holt. Mr. Holt is the DMVA Architect, on loan from the State Construction Office.

No agency-specific utility graphs/tables are included below since the DMVA utilities are paid through federal funds.

Department of Natural and Cultural Resources (DNCR)

The N.C. Department of Natural and Cultural Resources oversees the State's resources for the arts, history, libraries and nature. This includes 27 historic sites, seven history museums, two art museums, two science museums, three aquariums, 39 State parks and recreation areas, the N.C. Zoo, the N.C. Symphony, the State Library, the State Archives, the N.C. Arts Council, State Preservation Office, Office of State Archaeology, the African American Heritage Commission, and the Office of Land and Water Stewardship. This comprises approximately 1825 buildings across the State which account for over three million gross square feet of space. Tony Romaine is the energy manager for DNCR, but his primary position is a Facility Construction Engineer with the Capital Projects Unit based out of Raleigh. 2002-03 baseline data was estimated for DNCR to track EO80 progress, but this exercise could not be done for every year between 2002-03 and 2010-11 due to data availability limitations. Therefore, the figure below begins with DNCR's utility data in the 2010-11 fiscal year.

Figure 8: DNCR EUI

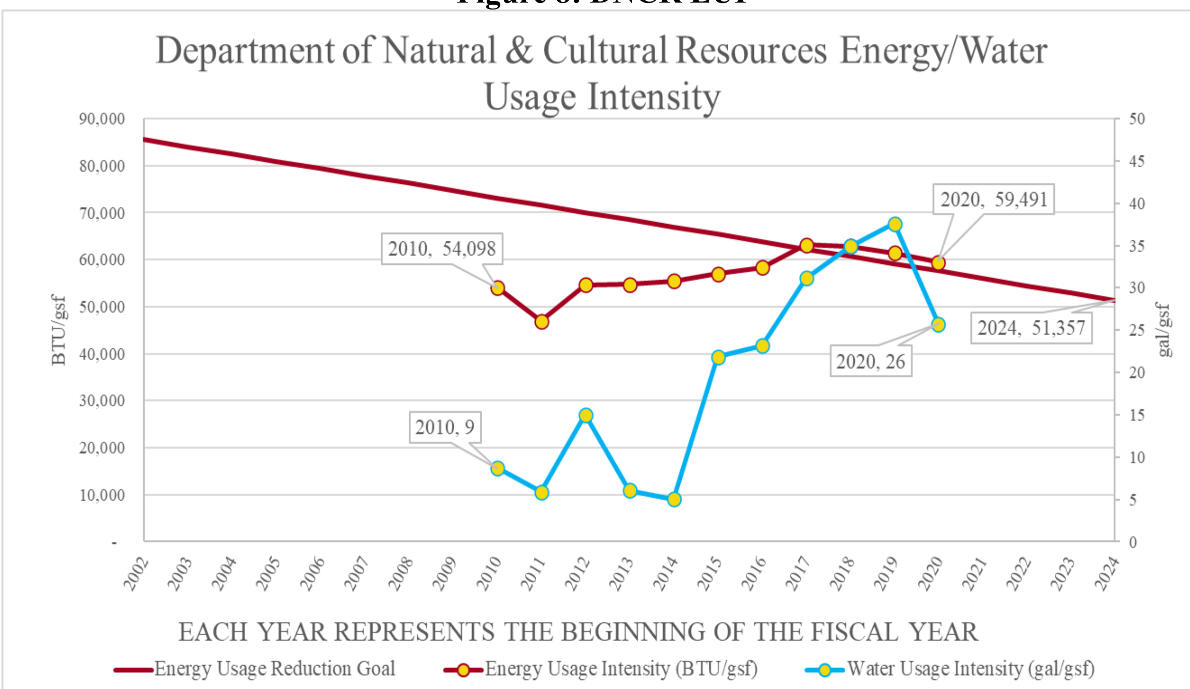

Table 6: DNCR Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	2,291,088	3,337,935	+46%
Total Utility Cost	$3,808,442	$5,694,096	+50%
Energy Usage (Btu/gsf)	85,595	59,491	-30%
Energy Cost ($/MMBtu)	$17.08	$23.93	+40%
Water Usage (gal/gsf)	32	26	-20%
Water Cost ($/kgal)	$6.25	$10.97	+75%

Department of Transportation (DOT)

The N.C. Department of Transportation, DOT, is responsible for all modes of transportation in North Carolina. This includes highways, rail, aviation, ferries, public transit, and bicycle and pedestrian transportation. The department also oversees the State's Division of Motor Vehicles and the Governor's Highway Safety Program, which promotes safety awareness to reduce highway crashes and fatalities. Additionally, DOT helps expand economic growth opportunities through oversight of the N.C. State Port Authority (NCSPA), N.C. Global TransPark and N.C. Turnpike Authority. DOT combined with the NCSPA occupies a total of 2382 buildings which amount to over nine million gross square feet spread throughout the State. The energy manager for the DOT is Eric Frazier whose primary job title is Energy Management Engineer for the Facilities Management Unit. He works out of the Raleigh DOT headquarters building.

Figure 9: DOT EUI

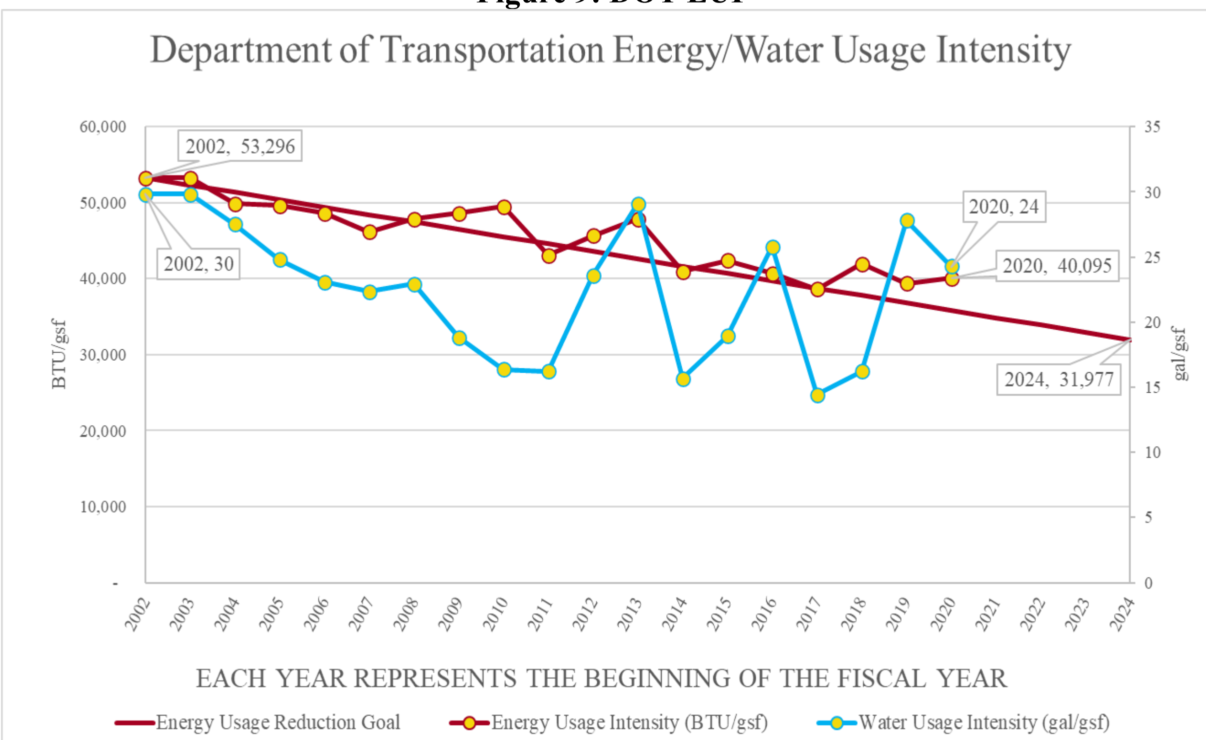

Table 7: DOT Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	8,784,848	9,376,737	+7%
Total Utility Cost	$9,341,426	$10,474,108	+12%
Energy Usage (Btu/gsf)	53,296	40,095	-25%
Energy Cost ($/MMBtu)	$17.02	$22.29	+31%
Water Usage (gal/gsf)	30	24	-19%
Water Cost ($/kgal)	$5.24	$9.21	+76%

Department of Revenue (DOR)

The DOR is tasked with administering tax laws and collecting tax revenue to fund public services for the citizens of North Carolina. The tax-funded public services include items such as schools, universities, roads, and public safety. To fulfill these tasks, the Department's vision is to protect customer information, maintain an expert workforce, achieve a high-level of understanding and compliance, respond with accurate information through innovative services, and to treat taxpayers fairly. The main DOR office building is located at 501 North Wilmington Street Raleigh, NC, 27604. This building is currently owned by the DOA, and utilities are reported through that agency. The DOR also occupies thirteen remote offices across the State that are housed in leased spaces so those utilities are not included in this report. Matthew King was designated as the energy manager for DOR, but his primary role is as Business Operations Facilities Manager.

No agency-specific utility graphs/tables are included below since the DOR reports utilities through the DOA.

Department of Public Safety (DPS)

The Department of Public Safety (DPS) manages facilities across the State that include prisons, juvenile detention centers, emergency management headquarters, and motor vehicle division sites. Also housed within DPS are the departments of Homeland Security and the National Guard. All of these divisions have the ability to be mobilized at any time and many of these facilities contain populations whose primary concern is not energy efficiency. In fact, many of these locations are required to maintain strict standards of comfort 24 hours a day seven days a week. DPS is the largest user of utilities among all the state agencies, and that utility spending is overseen by Paul Braese, who is the DPS Energy Manager. DPS is the only agency that for many years that has had a dedicated energy manager and a department focused solely on energy management. Paul's team supervises the collection of utility data through the Capturis program and works with other DPS departments performing energy projects and improvements.

Figure 10: DPS EUI

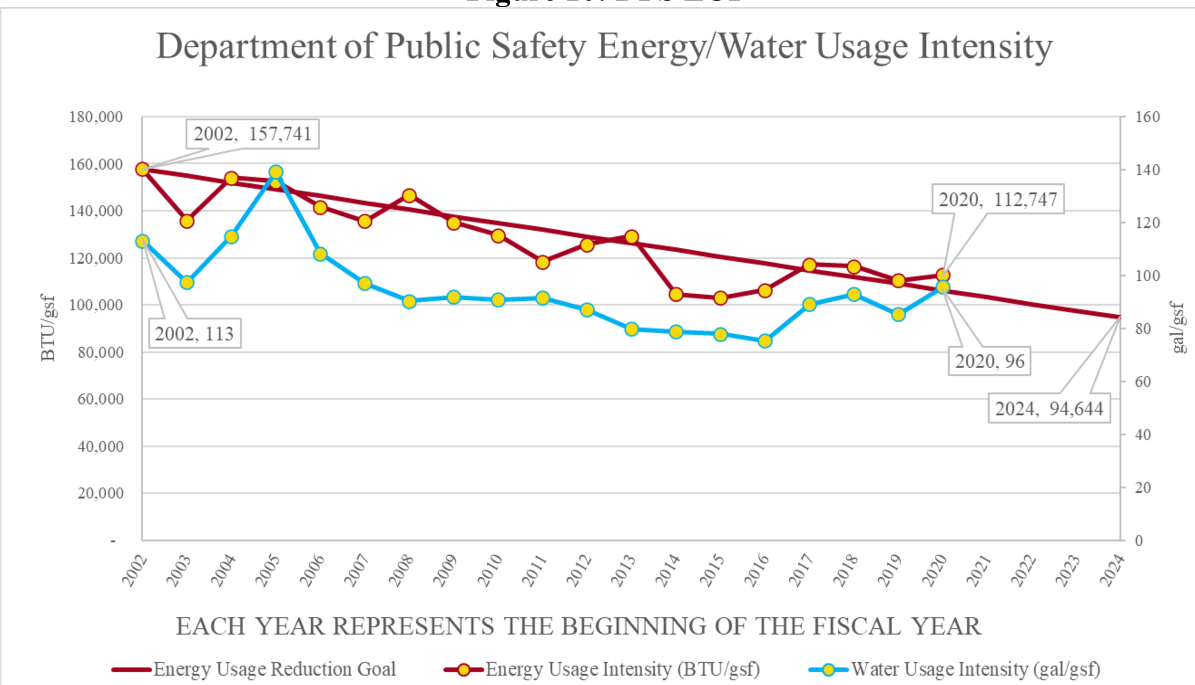

Table 8: DPS Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	11,581,135	18,018,243	+56%
Total Utility Cost	$32,284,715	$49,500,235	+53%
Energy Usage (Btu/gsf)	157,741	112,747	-29%
Energy Cost ($/MMBtu)	$12.43	$13.73	+10%
Water Usage (gal/gsf)	113	96	-15%
Water Cost ($/kgal)	$7.31	$12.54	+71%

Voluntary EUI Reduction Progress for Other State Agencies

Per EO80, the State of North Carolina strives to reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels. While the executive order applies directly to cabinet agencies, other state agencies are strongly encouraged to adopt the same goal. These other state agencies are the Department of Agriculture and Consumer Services, the Department of Justice, the Department of Public Instruction, and the Division of Wildlife Resources. Also, these agencies were not required under EO80 to appoint an energy manager.

Department of Agriculture and Consumer Services (NCDA&CS)

The North Carolina Department of Agriculture and Consumer Services has facilities across the State that include offices, storage, animal housing, chiller plants, food service, shops, housing, arenas, laboratories, greenhouses, and museums. In 2011, the department underwent major restructuring along with the Department of Natural Resources.

Figure 11: NCDA&CS EUI

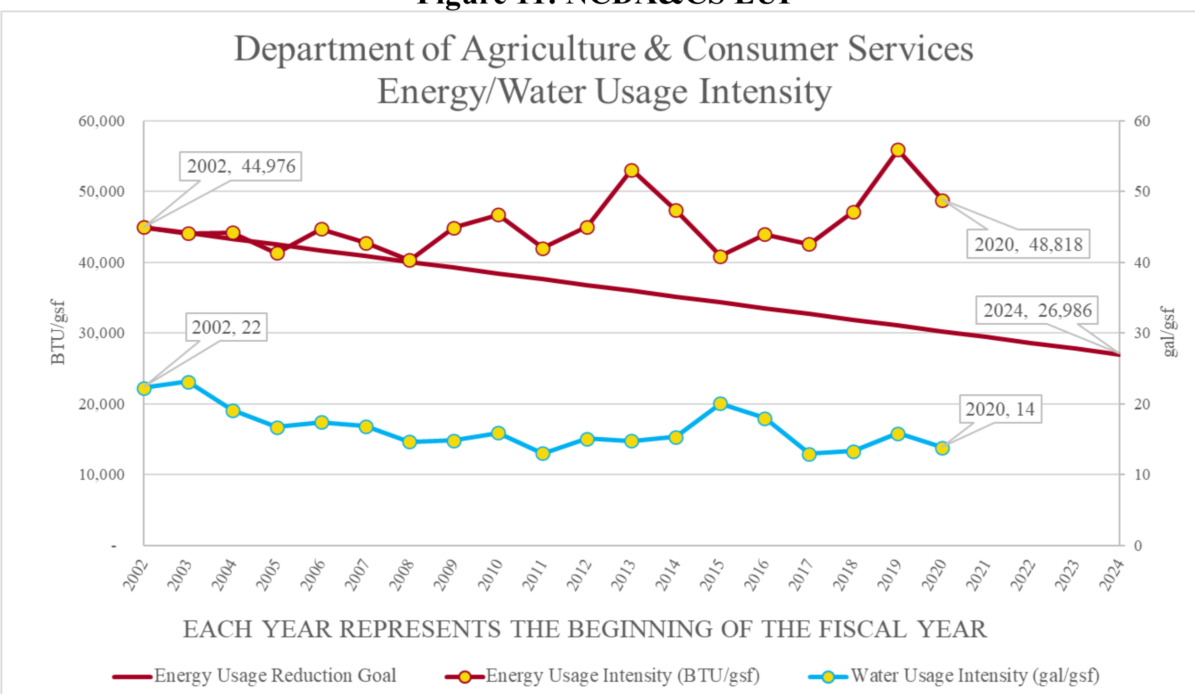

Table 10: NCDA&CS Utility Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	2,995,262	3,522,604	+18%
Total Utility Cost	$2,374,024	$4,045,152	+70%
Energy Usage (Btu/gsf)	44,976	48,818	+9%
Energy Cost ($/MMBtu)	$15.41	$19.10	+24%
Water Usage (gal/gsf)	22	14	-38%
Water Cost ($/kgal)	$4.47	$15.59	+249%

Department of Justice (DOJ)

The DOJ has two training academies that provide training for law enforcement personnel. The NC Justice Academies (NCJA) are in Salemburg and Edneyville totaling almost 300,000 square feet. These academies provide basic, intermediate, and advanced training for law enforcement officers (LEOs) on topics including anti-terrorism, community-oriented policing, criminal investigation, traffic crash investigation, firearms, self-defense, and management and supervision. The Western Crime Lab is also located at the Edneyville campus.

Figure 12: DOJ EUI

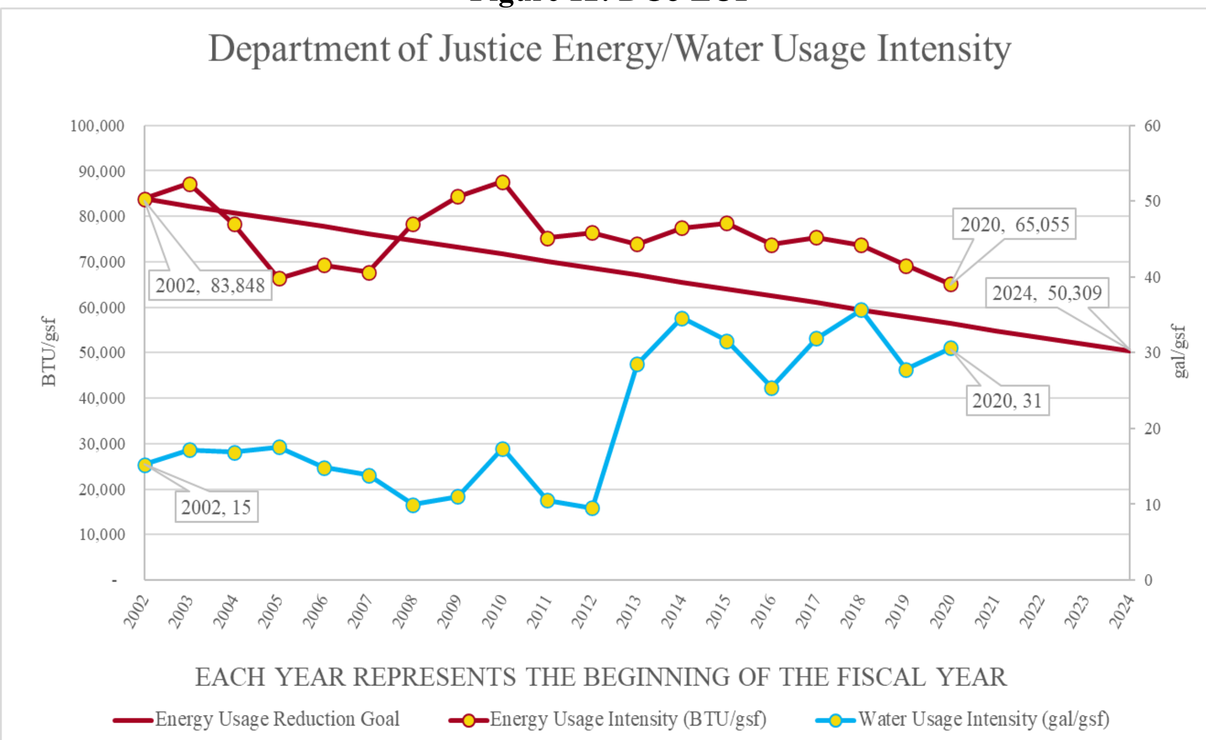

Table 11: DOJ Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	204,206	298,220	+46%
Total Utility Cost	$269,833	$438,097	+62%
Energy Usage (Btu/gsf)	83,848	65,055	-22%
Energy Cost ($/MMBtu)	$15.09	$20.61	+37%
Water Usage (gal/gsf)	15	31	+101%
Water Cost ($/kgal)	$3.71	$6.21	+68%

Department of Public Instruction (DPI)

The DPI administers educational funding, oversees the licensure of teachers and administrators, provides curriculum support, and evaluates student success for public schools. North Carolina's public school system encompasses approximately 2,500 district schools and 180 charter schools that prepare students for the modern workforce and further education. Currently, the department's administrative staff are housed in the Central Office in Raleigh as well as four regional licensing centers in Catawba, Concord, Elm City, and Fayetteville. A fundamental component of DPI is management of the Western School of the Deaf in Cullowhee, Morehead Governor's School in Raleigh, and the Eastern School of the Deaf in Wilson. All three facilities are designed to be residential or day learning institutions for visually or hearing-impaired children. Furthermore, the department leads two North Carolina Centers for the Advancement of Teaching (NCCAT) in Cullowhee and Ocracoke Island that are designed to professionally-develop and improve the classroom effectiveness of teachers. Jonathan Jones is assigned as the primary departmental energy manager for the DPI; however, Jonathan Long, Joshua Burris, and William Putman assist in covering the DPI's diverse geographic area. It is important to note that their energy management duties were applied as an additional requirement to their existing job responsibilities.

Figure 13: DPI EUI

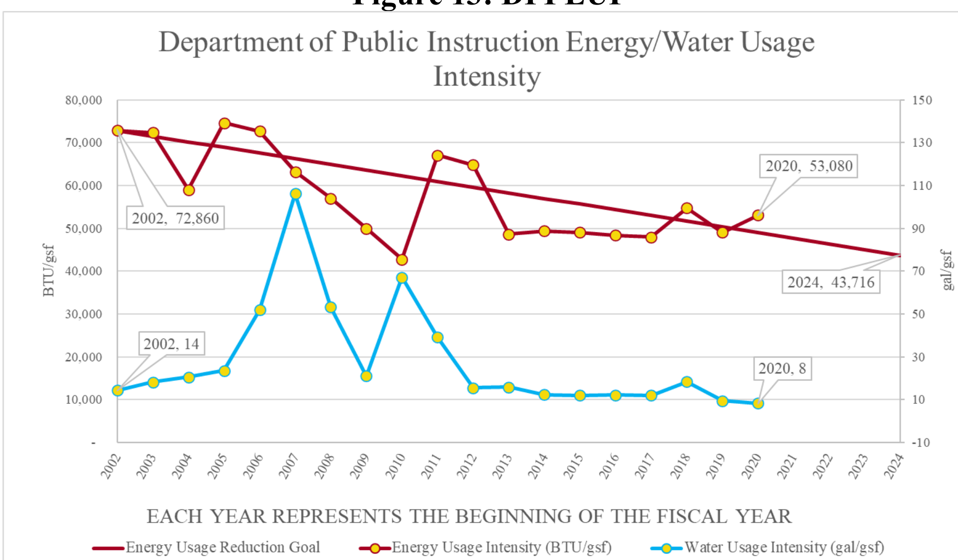

Table 12: DPI Progress

Metric	Fiscal Year 2002-03	Fiscal Year 2020-21	% Change
Total Gross Square Feet	713,347	663,259	-7%
Total Utility Cost	$747,574	$777,829	+4%
Energy Usage (Btu/gsf)	72,860	53,080	-27%
Energy Cost ($/MMBtu)	$12.91	$20.46	+58%
Water Usage (gal/gsf)	14	8	-42%
Water Cost ($/kgal)	$7.47	$10.36	+39%

Wildlife Resources Commission (WRC)

The N.C. Wildlife Resources Commission conserves and sustains the State's fish and wildlife resources through research, scientific management, wise use, and public input. The Commission is the regulatory agency responsible for the enforcement of fishing, hunting, trapping, and boating laws. Commission buildings are located across the State and include offices, pole barns, equipment storage, workshops, garages, residences, barns, animal housing, and laboratories.

Data is only available for WRC dating back to the 2005-06 fiscal year.

Figure 14: WRC EUI

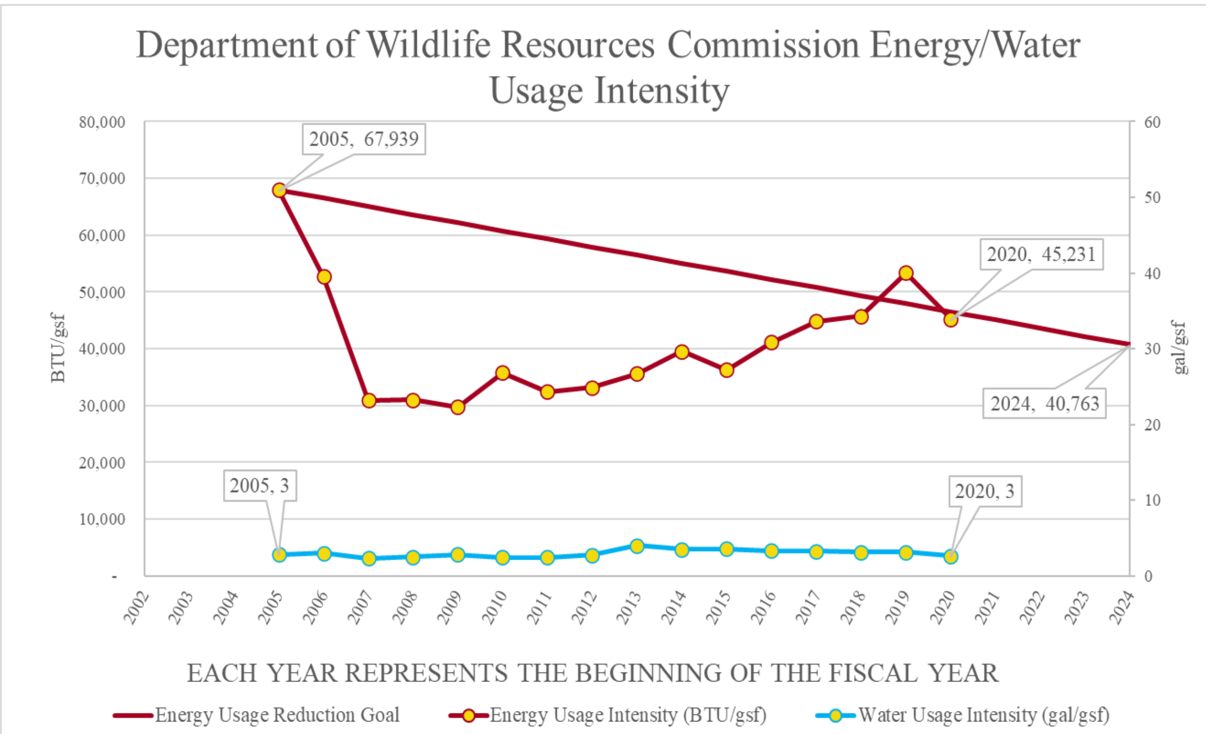

Table 13: WRC Progress

Metric	Fiscal Year 2005-06	Fiscal Year 2020-21	% Change
Total Gross Square Feet	161,093	342,083	+112%
Total Utility Cost	$222,601	$365,891	+64%
Energy Usage (Btu/gsf)	67,939	45,231	-33%
Energy Cost ($/MMBtu)	$20.00	$21.96	+10%
Water Usage (gal/gsf)	3	3	-8%
Water Cost ($/kgal)	$8.18	$29.15	+256%

Appendix B

Sources and Assumptions Used to Calculate Greenhouse Gas Offsets

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Sources and Assumptions Used to Calculate Avoided Greenhouse Gas Emissions

Introduction and Scope

This appendix documents the process to revise the avoided greenhouse gas emissions contained in the December 1, 2021, version of the report titled *"Comprehensive Program to Manage Energy, Water, and Other Utility Use for State Agencies and State Institutions of Higher Learning"*. The emissions were revised by utilizing the latest emission factors presented in the *"State Inventory and Projection Tool"*[11] (SIT) and the *"Emissions & Generation Resource Integrated Database"*[12] (eGRID) developed by the United States Environmental Protection Agency (USEPA). Additionally, equivalency results to translate emissions measurements into relatable terms were calculated by utilizing the *"Greenhouse gas Equivalencies Calculator"*[13] developed by the USEPA.

Quality Assurance Measures

Staff from the Utility Savings Initiative (USI) program applied quality assurance measures to ensure that the data meets indicator goals and objectives. For example, all raw utility consumption data utilized to calculate avoided emissions were checked for reasonableness against historical data from the same data category and geographic area (i.e., county, city, or state). In addition, all automated calculations and data processing operations performed by spreadsheet macros and database queries were validated by comparing to hand-calculated results.

Methodology to Calculate Avoided Greenhouse Gas Emissions

To generate the emission calculation conversion factors Table 1, the USI program utilized the following methodology:

1) **Kilowatt hours (kWh):** Prior to this report, the USI program historically applied one constant kWh emission factor for all fiscal years based on eGRID data. However, it was later determined that this methodology was incorrect since the average generation mix changes over time for fossil fuel-fired electricity generating units. As such, the old methodology significantly underestimated greenhouse gas emissions reductions from the electricity sector.

   Based on these findings, the USI program utilized the following general formula to develop updated emission factors in for the electricity sector for each fiscal year:

   $$MTCO_{2e} \text{ per kWh by Year} = (\text{eGRID Emission Rate by Year (lb CO2e/kWh)}) / (2204.62 \text{ lb/metric ton})$$

   Please note: 2005, 2007, 2009, 2010, 2012, 2014, 2016, 2018, and 2019 emission rate values *(lb/kWh)* were taken from eGRID data files released by the USEPA *(which is typically updated every two years)*. Based on these values, emission factors are interpolated for intermediate years *(i.e., (base + future year) / 2))* and held constant for the beginning and end of the time series *(i.e., 2002 through 2004; and 2020 and 2021)*.

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[11] https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
[12] https://www.epa.gov/egrid/download-data
[13] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

2) **Therms:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for natural gas:

Total CO_{2e} Emission Factor for Therms = *(((SIT Tool's $MTCO_{2e}$/Btu * 1.00E-05 therm/Btu conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) / (1,000,000,000 Btu/BBtu conversion factor) / (1.00E-05 therm/Btu conversion factor)) * (25 global warming potential factor for CH_4)) + (((SIT Tool's MTN_2O/BBtu) / (1,000,000,000 Btu/BBtu conversion factor) / (1.00E-05 therm/Btu conversion factor)) * (298 global warming potential factor for N_2O)))*

-Or Simply-

Total CO_{2e} Emission Factor for Therms = *($MTCO_{2e}$/therm for CO_2) + ($MTCO_{2e}$/therm for CH_4) + ($MTCO_{2e}$/therm for N_2O)*

Please note: The same emission factor for therms was applied to all fiscal years since emissions from natural gas were assumed to remain relatively constant over time.

3) **Number 2 Distillate Oil:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for distillate oil:

Total CO_{2e} Emission Factor for Number 2 Distillate Oil = *(((SIT Tool's $MTCO_{2e}$/Btu * 138,690 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (138,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (138,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Number 2 Distillate Oil = *($MTCO_{2e}$/gal distillate oil for CO_2) + ($MTCO_{2e}$/gal distillate oil for CH_4) + ($MTCO_{2e}$/gal distillate oil for N_2O)*

Please note: The same emission factor for fuel oil was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

4) **Number 6 Residual Oil:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for the *"residential/commercial"* sector for residual oil:

Total CO_{2e} Emission Factor for Number 2 Residual Oil = *(((SIT Tool's $MTCO_{2e}$/Btu * 149,690 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (149,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (149,690 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Number 6 Residual Oil = *($MTCO_{2e}$/gal residual oil for CO_2) + ($MTCO_{2e}$/gal residual oil for CH_4) + ($MTCO_{2e}$/gal residual oil for N_2O)*

Please note: The same emission factor for residual oil was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

5) **Propane:** The USI program utilized the SIT tool *(see Table 2)* and the following general formula to create the emission factors for propane:

Total CO_{2e} Emission Factor for Propane = *(((SIT Tool's $MTCO_{2e}$/Btu * 91,648 Btu/gal conversion factor)) + (((SIT Tool's $MTCH_4$/BBtu) * (25 global warming potential factor for CH_4) * (91,648 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)) + (((SIT Tool's MTN_2O/BBtu) * (298 global warming potential factor for N_2O) * (91,648 Btu/gal conversion factor)) / (1,000,000,000 Btu/BBtu conversion factor)))*

-Or Simply-

Total CO_{2e} Emission Factor for Propane = *($MTCO_{2e}$/gal propane for CO_2) + ($MTCO_{2e}$/gal propane for CH_4) + ($MTCO_{2e}$/gal propane for N_2O)*

Please note: The same emission factor for propane was applied to all fiscal years since emissions were assumed to remain relatively constant over time.

Table 1: Emission Calculation Conversion Factors

Emission Factors					
Year	**$MTCO_{2e}$/kWh**	**$MTCO_{2e}$/Therm**	**$MTCO_{2e}$/Gal 2 Oil**	**$MTCO_{2e}$/Gal 6 Oil**	**$MTCO_{2e}$/Gal Propane**
2002-03	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2003-04	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2004-05	0.000555763	0.005318772	0.010317173	0.011304793	0.005706251
2005-06	0.00055765	0.005318772	0.010317173	0.011304793	0.005706251
2006-07	0.000561424	0.005318772	0.010317173	0.011304793	0.005706251
2007-08	0.000554367	0.005318772	0.010317173	0.011304793	0.005706251
2008-09	0.000536479	0.005318772	0.010317173	0.011304793	0.005706251
2009-10	0.000533099	0.005318772	0.010317173	0.011304793	0.005706251
2010-11	0.000524392	0.005318772	0.010317173	0.011304793	0.005706251
2011-12	0.000495851	0.005318772	0.010317173	0.011304793	0.005706251
2012-13	0.000473062	0.005318772	0.010317173	0.011304793	0.005706251
2013-14	0.000456026	0.005318772	0.010317173	0.011304793	0.005706251
2014-15	0.000434589	0.005318772	0.010317173	0.011304793	0.005706251
2015-16	0.000408751	0.005318772	0.010317173	0.011304793	0.005706251
2016-17	0.000387544	0.005318772	0.010317173	0.011304793	0.005706251
2017-18	0.000370968	0.005318772	0.010317173	0.011304793	0.005706251
2018-19	0.000358137	0.005318772	0.010317173	0.011304793	0.005706251
2019-20	0.000353594	0.005318772	0.010317173	0.011304793	0.005706251
2020-21	0.000353594	0.005318772	0.010317173	0.011304793	0.005706251

Table 2: State Inventory and Projection Tool Emission Factors[14]

Fuel Type	**Carbon Dioxide**		**Methane**		**Nitrous Oxide**	
Natural Gas (Res/Comm)	5.30549E-08	MTCO2e/ Btu	0.00475	MTCH4/ BBtu	0.00009	MTN2O /BBtu
Natural Gas (Res/Comm)	5.30E-03	MTCO2e/ therm	1.19E-05	MTCO2e/ therm	2.68E-06	MTCO2 e/therm
No. 2 Fuel Oil (Res/comm)	7.39609E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
No. 2 Fuel Oil (Res/comm)	0.010257634	MTCO2e/ gal	3.47418E-05	MTCO2e/ gal	2.47978E-05	MTCO2 e/gal
No. 6 Dist Oil (Res/comm)	7.50918E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
No. 6 Dist Oil (Res/comm)	0.011240531	MTCO2e/ gal	3.74975E-05	MTCO2e/ gal	2.67647E-05	MTCO2 e/gal
Propane	6.18334E-08	MTCO2e/ Btu	0.01002	MTCH4/ BBtu	0.0006	MTN2O /BBtu
Propane	0.005666907	MTCO2e/ gal	2.29578E-05	MTCO2e/ gal	1.63867E-05	MTCO2 e/gal

[14] https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool

Collective Avoided Greenhouse Gas Emissions

By utilizing the methodology described in the previous section, Table 3 and Table 4 represent the avoided greenhouse gas emissions for state agencies and the UNC System (i.e., state-owned buildings). Table 3 provides avoided greenhouse gas emissions since the FY2002-03 baseline. In addition, Table 4 provides a snapshot of avoided greenhouse gas emissions data to show the program's effectiveness during the most recent fiscal year (FY2020-21).

Table 3: FY2002-03 to FY2020-21 Avoided Greenhouse Gas Totals

Fuel Source	State Agencies ($MTCO_{2e}$)	UNC System ($MTCO_{2e}$)	All State Government Units ($MTCO_{2e}$)
Electricity Usage	1,875,292	4,520,839	**6,396,130**
Nat Gas Usage	-107,723	-286,254	**-393,977**
Fuel Oil Usage	559,122	1,327,627	**1,886,749**
Propane Usage	56,233	5,134	**61,366**
Total	**2,382,923**	**5,567,346**	**7,950,269**

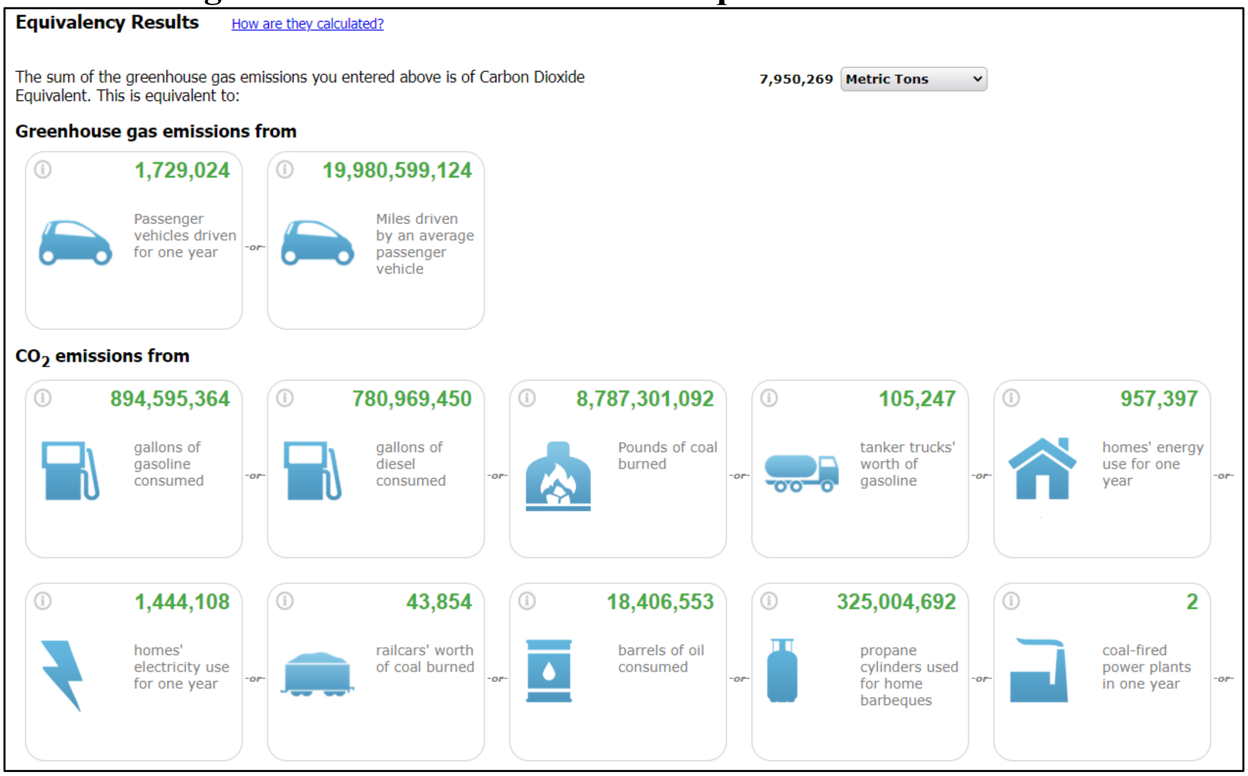
Table 4: FY2020-21 Avoided Greenhouse Gas Totals

Fuel Source	State Agencies ($MTCO_{2e}$)	UNC System ($MTCO_{2e}$)	All State Government Units ($MTCO_{2e}$)
Electricity Usage	211,451	601,930	**813,381**
Nat Gas Usage	2,813	-34,898	**-32,085**
Fuel Oil Usage	42,790	97,177	**139,966**
Propane Usage	3,304	890	**4,194**
Total	**260,359**	**665,098**	**925,456**

Greenhouse Gas Equivalencies

Figure 1 contains a screenshot of the USEPA's greenhouse gas equivalencies calculator[15] based on total avoided emissions since the 2002-03 baseline for state-owned buildings. As shown, the figure provides relatable terms for the program's environmental success.

Figure 1: EPA Greenhouse Gas Equivalencies Calculator



[15] *EPA Greenhouse Gas Equivalencies Calculator;* [*https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator*](https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator)

Appendix C

Agency Utility Management Plans

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NORTH CAROLINA
DEPARTMENT OF ADMINISTRATION
ENERGY USAGE REPORT 2019-20

Prepared By: Design & Consulting Services Section
State Construction Office

PURPOSE

The Department of Administration (DOA) reports energy and water usage annually and includes the figures in the Energy Management Plan. Reporting originally was done annually in accordance with the requirements of GS 143-64.12. It also addresses reporting requirements of EO-80, dated October 29, 2018. The baseline year is FY 2002-03.

OVERVIEW

For last year's report, DOA, in response to requests from DEQ, reviewed and revised the Gross Square Footage (GSF) figures used for energy reporting. DOA is assigned most of the State buildings in the Raleigh Downtown Government Campus and DOA Facility Management is responsible for operating and maintaining these buildings, including paying the water, electric, and natural gas utility bills. DOA operates a central steam heating plant, two chilled water plants, and chilled water storage tanks. These plants provide chilled water and steam to many of the DOA buildings and a few buildings that are being reported to the Energy Office by other state agencies. This report continues to focus primarily on the Downtown Complex, using the baseline revised for the 2018-19 report.

Revised baseline: Previous reporting included additional buildings. The table below shows the revised baseline. For additional information, refer to notes on DOA energy reporting; parking decks; and, buildings.

FY	Energy + Water Cost ($)	Total Energy Cost ($)	Total Energy Usage (Btu)	Total Water + Sewer Cost ($)	Total water Usage (mgal)	Total Building Area (gsf)	Energy Tracking Measure (Btu/gsf)	Energy Reduction from Baseline (%)
2002-03	$8,621,411	$8,621,411	696,827,809,264	Not Available	Not Available	4,659,040	149,565	NA
Revised 2002-03	$7,894,926	$7,894,926	473,446,975,544	Not Available	Not Available	3,653,063	129,603	NA

CURRENT ENERGY PERFORMANCE

The table below identifies the DOA baseline energy usage of 2002-03 (revised) and the present energy usage for 2018-19, and 2019-20.

FY	Energy + Water Cost ($)	Total Energy Cost ($)	Total Energy Usage (Btu)	Total Water + Sewer Cost ($)	Total water Usage (mgal)	Total Building Area (gsf)	Energy Tracking Measure (Btu/gsf)	Energy Reduction from Baseline (%)
Revised 2002-03	$7,894,926	$7,894,926	473,446,975,544	Not Available	Not Available	3,653,063	129,603	NA
2018-19	$7,559,514	$7,060,624	460,262,263,776	$498,890	39,611	4,084,314	112,718	-13.0%
2019-20	$6,553,802	$6,024,098	446,307,164,846	$529,704	45,140	4,084,314	109,273	-15.7%

Based upon baseline data reported in FY2002-03, DOA is reporting an Energy Reduction of 15.7%. Water reporting has been erratic and as such, the baseline was not reported. DOA did report water usage for FY 2018-19 and FY2019-20.

DOA Energy Reporting:

The Baseline and subsequent reporting of energy data has been dependent in large part on a database and reporting tool that is fraught with errors. The database tool includes report generation that is now known to generate reports that include corrupted data. Some reports drop individual monthly data that is contained in the database. The database was originally designed as a DOS-based system and does not meet the current IT standards. DOA will not renew the contract for this system. A task group is reviewing options for a replacement that meeting IT standards and provides accurate reporting capabilities. This energy usage report is based on energy billing and usage data available, with acknowledgement that it contains incomplete data due to the limitations of the energy database tool in use.

Parking Decks:

In 2018 and 2019, DEQ questioned the square footage reported by DOA. In large part, the question was the inclusion of parking decks in the energy reporting. In 2019, efforts were made to reconcile the square footage and baseline figures. Parking deck square footage is not included in the energy usage reporting.

Parking Deck 65 is attached to five (5) Downtown Government Complex buildings: Archdale Building; Dobbs Building; New Revenue Building; New Education Building; and Legislative Office Building (LOB). Parking Deck 65 does not have its own electrical service or electrical meter. It was built in phases, as the buildings around Halifax Mall were built. There is no practical way to segregate the electrical usage of the parking deck from the surrounding buildings. The parking deck energy usage includes lighting and exhaust fans for ventilation. In addition, automatic roll-up doors add to the electrical load.

Parking Deck 77 was built as part of the Green Square project. The square footage increased with the addition of Nature Resource Center (NRC), DENR/DEQ Office Building, and Parking Deck 77. An effort has been made to be more transparent about the buildings and square footage included in the report.

Parking Deck 17 sits below the Museum of History. Notes on the energy reporting template indicated that Museum of History included 301,000 GSF for parking deck. The Museum of History is being reported as 190,099 GSF, as reflected in the State Property Office (SPO) database. This does not include additional square footage for Parking Deck 17.

The billing and meter data is stored in a database that has a web interface for extracting or reporting data. The software package, Willowtec, was one of the early tools used in State Government for energy reporting. In 2001-02 it was considered by some ahead of its time; however, it falls short of meeting even its initial intent. The constraints associated with the program are clear indications it is not adequate for the energy management needs of DOA. Review of the data in the database reveal that it contains some discrepancies. DOA is researching other options that are better suited to meet its utility metering and billing data management and reporting needs. Available options can help DOA make better use of the data as a management tool, as well as providing a tool for reporting to meet the reporting requirements of EO-80. Available information indicates that DOA is opted-in for the energy efficiency rider charged by the electric utility, without making full use of the energy efficiency resources funded by this rider. DOA is exploring other energy data management tools. Opting out of the energy efficiency rider may provide some funding to go toward the new energy data tool.

Buildings included in the Willowtec database include buildings that are not DOA buildings. Efforts were made to reconcile GSF figures, as well as identify the groups of buildings that are included. The SPO data was used to identify buildings, agency, square footage, and construction year.

Buildings (Background and Notes):

The revised baseline includes only the DOA owned and operated buildings in the Downtown Government Complex.

Legislative Building (LB) and Legislative Office Building (LOB) do not fall under DOA and are not included in the DOA square footage. The steam and chilled water supplied to LB and LOB are included in the energy report. Steam and chilled water supplied by the central plants to LB and LOB have not been separately metered. SPO lists the size of the buildings as 165,786 GSF and 166,144 GSF, respectively.

Highway Building, Former Art Museum, and Olivia Raney Building, all located in downtown Raleigh, are Department of Transportation (DOT) maintained and operated, and are not included in the DOA reporting.

Department of Military and Veteran Affairs (DMVA) is now a separate department. Prior to being named a department, it was a division within DOA. Currently the only building that falls under DOA is the Seaboard Building, owned and operated by DOA, and occupied by DMVA.

Garner Road Complex – Department of Public Safety – State Highway Patrol – Garner Road.

Motor Fleet and Textbook Warehouse are outside of the Downtown Government Complex. These buildings are located on Blue Ridge Road.

Federal Surplus – The Federal Surplus Warehouse is listed by the SPO database as a total of 70,418 GSF. It is not included in the DOA Downtown Government Complex and is not included in the report.

State Surplus Warehouse is listed by the SPO database as 41,164 GSF. It is not included in the DOA Downtown Government Complex and is not included in the report.

North Carolina Museum of Art – Located on Blue Ridge Road and listed by SPO as Department of Natural and Cultural Resources (DNCR).

State Public Health Lab, constructed 2012, is a Department of Health and Human Services (DHHS) building.

State Crime Lab - Listed by SPO as Attorney General-Justice.

For Natural Gas cost and usage, the database does not include complete information. Several of the smaller buildings have cost data, but do not quantify units of natural gas consumption in therms. Estimates were calculated to express energy in therms, so as to be able to report total btus.

North Carolina
Department of Commerce
Division of Employment Security

Utility Management Plan

March, 2021

Utility Management Plan

Contents

Executive Summary

Introduction

The Utility Management Plan began development as the Strategic Energy Plan. The Strategic Energy Plan was originally developed in accordance with General Statutes 143-64.12 (b) to support statewide efforts in improving the energy efficiency of state-owned facilities (see Appendix 1). The Strategic Energy Plan has been superseded by the Utility Management Plan in accordance with Executive Order 80.

The DES Central Office, at 700 Wade Avenue, is comprised of 246,039 square feet of space (interior gross) and nine wings. The utility plant consists of two steam boilers (150 horsepower each), and two chillers (350 tons each). This equipment provides comfort cooling and heating only. The facility provides approximately 400 persons general office space usually between 6 AM and 7 PM, five days per week. DES owns the Central Office space and leases nearly 27,913 square footage of office space in 2 locations in Raleigh and Charlotte.

This Plan encompasses five focus areas; Utility Accounting, Procurement Management, Building Energy Use, Equipment Efficiency and Organization Integration. The Plan is built around seven sections:

1) Baseline Energy Use 2002/2003 (benchmarking)
2) Planned Actions and Projects
3) Savings Opportunity Assessment

4) Financial Assessment
5) Goals and Measures
6) Budgeting
7) The Energy Mandate

This Plan will be updated and submitted on a biennial basis to the Department of Environmental Quality.

1. Baseline Energy Use

The Executive Order 80 established the calendar year 2002-2003 as the baseline for its energy program as a starting point from which to measure improvement. The measure consists of a cost of $1.53/sf, and a consumption rate of 105.5 kBTU/sf (see appendix 2). The DES Central Office measurements currently use a square footage of 261,091 (gross interior) sq. ft.

Appendix number 2 contains a break down by energy source of the usage and cost data per square foot for the campus.

2. Planned actions and Projects

The Division of Employment Security Wade Avenue Central Office has been deemed surplus by the NC Department of Administration. This has significantly affected the overall objective and dynamics of the DES Utility Management Plan. Planned actions and projects must have the intent and goal of final compliance with Executive Order 80 while remaining fiscally responsible in respect to taxpayer funding and the future of the 700 Wade Avenue complex. A consolidated, comprehensive Utility Management Plan is attached in Appendix 3

A. Plans

Energy Data Management: The Support Services Division established Excel spreadsheets for collecting and analyzing the monthly energy billing information. The energy monitor reviews the data with the Division Director to identify and analyze excessive variations and to target areas for follow-up studies.

Energy Use in Facilities: Through attrition and project funding DES will continue to replace or modify existing systems with more modern energy efficient equipment. This effectively will reduce resource consumption throughout the facility.

Equipment Efficiency: The maintenance staff operates under a robust preventative maintenance program that ensures efficient operation of our physical plant and air handlers throughout the facility. The staff walks the campus several times per day to keep close tabs on any mechanical failures. The automated controls assist in monitoring the entire site system. In addition, DES conducts annual boiler and chiller/cooling tower tune-ups to maintain efficiency.

Organization Integration: The Assistant Secretary assigned day-to-day responsibility for the energy management program to the Director of Support Services. Support Services staff monitors energy consumption and costs and provides the resources to maintain the equipment.

DES compiled, reviewed, and incorporated suggestions and information from several sources (power company survey, State Construction survey, Department of Environmental Quality, and others) to determine improvement actions. The assessment process identified actions that if put into place could improve the DES energy conservation performance. In the Utility Management Plan, these actions are addressed under the following sections.

Process Improvement
Program Implementation
Savings Estimate & Financial Evaluation
Projects

Process Improvement:

A comprehensive continuous review of policies and procedures by the Energy Manager and staff to ensure procedures include energy efficiency best practices.
Assigned to: Energy Manager Continuous

Continue to improve the operation of the HVAC system through improved controls and assessments by outside consultants.
Assigned to: Support Services Director Continuous

Continued scheduling maintenance of facility related equipment, i.e. boilers, chillers, and air handlers during off peak hours only.
Assigned to: Support Services Director Continuous

Program Implementation:

Seek out and provide training opportunities for the maintenance staff to maintain proficiency in operations and to keep abreast of new technologies.
Assigned to: Support Services Director Continuous

3. Savings Estimate & Financial Evaluation:

The Support Services Division is always looking for better ways to enhance our energy conservation program, while evaluating further potential savings and financial impacts. Utility bills are reviewed monthly to evaluate the overall results of energy saving initiatives.

Projects

Due to pending sale of the facility, no major capital improvement projects are scheduled at this time.
Low cost and no cost conservation strategies are in constant development and deployment throughout the facility.

Section 4: Financial Assessment

DES works closely with architects and engineers in developing alternatives to improving our infrastructure. Additionally, DES works with the State Construction Office on the best method in which to execute these projects. Finally, DES works closely with our Finance and Budget office to determine the most prudent time to accomplish any improvements based on availability of funds and payback assessments. Where applicable and feasible a return on investment calculation is prepared to better evaluate cost. The 700 Wade Avenue Facility has been identified as surplus property and will be sold after a new facility is appropriated for the agency. Any capital expenditures must be fiscally responsible in accordance with the pending relocation.

Section 5: Goals and Measures

DES's primary goal of the Utility Management Plan is to reduce per square foot energy usage by 40% by 2025

The measurement system uses the following criteria to meet the Utility Management Plan goal:

- Total utility consumption (power, gas) per square foot
- Initial investment versus cost avoidance
- Guarantee of continued service to customer

Section 6: Budget

DES uses Federal grant funds to accomplish facility improvements. We look at cost effectiveness, as well as, need to assess the best use of the taxpayer's money.

Section 7: Mandate for Energy Management

Energy and energy management must be recognized as a controllable operating expense where in savings can result in funding being available for other program needs. If the energy management program is to be successful, all members of the DES staff have important roles to play. Energy cost reduction must become a vital part of the DES Utility Management Plan.

As an integral part of this Energy Strategic Plan, the DES established an Energy Mandate (see appendix 4).

Appendices

1. Utilities Spreadsheet: 2000-2020
2. Utility Management Plan
3. General Statutes Article 3B
4. Energy Mandate

Appendix 1
Utility Data

year	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $
1999-00	$508,025	$508,025	35,440,912,128	7,113,544	$431,916	111,695	$76,109
2000-01	$524,460	$524,460	34,635,978,166	6,687,596	$412,934	118,179	$111,527
2001-02	$384,142	$384,142	24,180,259,756	5,040,463	$337,212	69,822	$46,930
2002-03	$398,568	$398,568	27,553,553,592	5,420,766	$307,227	90,579	$91,341
2003-04	$385,680	$385,680	26,426,656,940	5,239,495	$306,706	85,495	$78,974
2004-05	$401,969	$401,969	25,442,300,480	5,072,040	$308,006	81,365	$93,964
2005-06	$399,623	$399,623	25,959,720,804	5,066,917	$319,663	86,714	$79,960
2006-07	$579,893	$526,987	26,259,454,380	5,138,615	$428,218	87,265	$98,769
2007-08	$439,222	$391,104	25,857,586,476	5,059,023	$312,644	85,962	$78,460
2008-09	$439,883	$408,319	24,321,665,000	4,451,250	$308,522	91,340	$99,797
2009-10	$492,919	$461,355	26,995,824,000	5,127,000	$385,828	95,025	$75,527
2010-11	$437,027	$405,463	27,941,797,364	5,382,297	$405,435	95,774	$64,033
2011-12	$429,622	$429,622	30,253,357,000	6,042,250	$429,622	96,372	$64,359
2012-13	$522,432	$473,597	32,012,825,000	5,806,250	$398,605	122,019	$74,992
2013-14	$408,615	$363,840	26,780,142,000	4,303,500	$277,855	120,966	$85,985
2014-15	$513,753	$466,425	33,523,071,000	5,951,750	$380,477	132,157	$85,948
2015-16	$477,533	$446,724	30,614,821,000	5,264,250	$380,651	126,532	$66,073
2016-17	$467,705	$419,353	30,222,011,940	5,123,245	$356,326	127,415	$63,027
2017-18	$492,371	$434,168	34,489,422,000	5,193,500	$349,669	167,692	$84,499
2018-19	$554,730	$508,887	36,034,543,920	5,141,660	$407,563	184,912	$101,324
2019-20	$334,274	$314,219	25,434,021,000	3,539,250	$251,188	133,581	$63,103

Fiscal year	energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal
1999-00		$1.95	$14.334		135,742			$0.00
2000-01	$12,188	$2.01	$15.142	6%	132,659	-2%	$0	$0.00
2001-02	$178,893	$1.47	$15.887	11%	92,612	-32%	$0	$0.00
2002-03	$114,092	$1.53	$14.465	1%	105,532	-22%	$0	$0.00
2003-04	$131,557	$1.48	$14.594	2%	101,216	-25%	$0	$0.00
2004-05	$157,970	$1.54	$15.799	10%	97,446	-28%	$0	$0.00
2005-06	$145,953	$1.53	$15.394	7%	99,428	-27%	$0	$0.00
2006-07	$184,258	$2.02	$20.068	40%	100,576	-26%	-$52,906	$5.00
2007-08	$144,951	$1.38	$15.125	6%	99,037	-27%	-$48,118	$10.00
2008-09	$186,673	$1.56	$16.788	17%	93,154	-31%	-$31,564	$5.12
2009-10	$144,326	$1.77	$17.090	19%	103,396	-24%	-$31,564	$5.12
2010-11	$108,821	$1.55	$14.511	1%	107,019	-21%	-$31,564	$5.12
2011-12	$73,667	$1.65	$14.201	-1%	115,873	-15%	-$31,564	$5.12
2012-13	$50,715	$1.81	$14.794	3%	122,612	-10%	-$48,835	$8.05
2013-14	$117,667	$1.39	$13.586	-5%	102,570	-24%	-$44,776	$7.37
2014-15	$26,684	$1.79	$13.914	-3%	128,396	-5%	-$47,328	$14.12
2015-16	$70,421	$1.71	$14.592	2%	117,257	-14%	-$30,809	$23.61
2016-17	$72,416	$1.61	$13.876	-3%	115,753	-15%	-$48,352	$16.86
2017-18	$11,978	$1.66	$12.588	-12%	138,015	-3%	-$45,843	$15.72
2018-19	-$8,383	$1.95	$14.122	-1%	138,015	2%	-$45,843	$20.01
2019-20	$123,656	$1.20	$12.357	-14%	97,414	-28%	-$19,983	$951,.57

Appendix 2
Utility Management Plan

2020-21

Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect EE strategy toward 40% reduction in Btu/gsf.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2020-21 Planned Activities	Expected Measurement	Assigned To	Occurrence
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Monthly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager and staff	October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	(add dates of training)
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager and staff	
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager and staff	
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager	Quarterly
Track utility data	Collect annual utility data submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year

2020-21

Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Determine cost feasibility of projects
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	Expected Measurement	Assigned To	Occurrence
Continual Lighting Retrofit	32 watt T8 replaced with 13 watt LED	Maintenance Staff	continuous
Meet with automation vendor to investigate low no cost changes to improve efficiency	Automated energy conservation measures	Energy Manager	June, 2021
Adjust policies and post order to include energy conservation best practices	Disseminate information on new procedures to staff for added efficiency while ensuring continuity of building services during working hours.	Energy Manager and Agency Staff	Continuous
HVAC systems optimization.	Dynamic adjustment of setpoints to match ambient temperatures. Savings dependent on amount of heating and cooling degree days.	Maintenance Staff	Continuous
Low cost conservation equipment solutions	Implement low cost energy conservation equipment.	Energy Manager	Continuous
Replace Kewanee boiler burner with efficient low turn down model	Waiting on data	Energy Manager	April 2021

Appendix 3

Article 3B.

Conservation of Energy, Water, and Other Utilities in Government Facilities.

Part 1. Energy Policy and Life-Cycle Cost Analysis.

§ 143-64.10. Findings; policy.

(a) The General Assembly finds all of the following:

(1) That the State shall take a leadership role in aggressively undertaking the conservation of energy, water, and other utilities in North Carolina.

(2) That State facilities and facilities of State institutions of higher learning have a significant impact on the State's consumption of energy, water, and other utilities.

(3) That practices to conserve energy, water, and other utilities that are adopted for the design, construction, operation, maintenance, and renovation of these facilities and for the purchase, operation, and maintenance of equipment for these facilities will have a beneficial effect on the State's overall supply of energy, water, and other utilities.

(4) That the cost of the energy, water, and other utilities consumed by these facilities and the equipment for these facilities over the life of the facilities shall be considered, in addition to the initial cost.

(5) That the cost of energy, water, and other utilities is significant and facility designs shall take into consideration the total life-cycle cost, including the initial construction cost, and the cost, over the economic life of the facility, of the energy, water, and other utilities consumed, and of operation and maintenance of the facility as it affects the consumption of energy, water, or other utilities.

(6) That State government shall undertake a program to reduce the use of energy, water, and other utilities in State facilities and facilities of the State institutions of higher learning and equipment in those facilities in order to provide its citizens with an example of energy-use, water-use, and utility-use efficiency.

(b) It is the policy of the State of North Carolina to ensure that practices to conserve energy, water, and other utilities are employed in the design, construction, operation, maintenance, and renovation of State facilities and facilities of the State institutions of higher learning and in the purchase, operation, and maintenance of equipment for these facilities. (1975, c. 434, s. 1; 1993, c. 334, s. 2; 2001-415, s. 1; 2006-190, s. 8; 2007-546, s. 3.1(b).)

§ 143-64.11. Definitions.

For purposes of this Article:

(1) "Economic life" means the projected or anticipated useful life of a facility.

(2) "Energy-consumption analysis" means the evaluation of all energy- consuming systems, including systems that consume water or other utilities, and components of these systems by demand and type of energy or other utility use, including the internal energy load imposed on a facility by its occupants, equipment and components, and the external energy load imposed on the facility by climatic conditions.

(2a) "Energy Office" means the State Energy Office of the Department of Environmental Quality.
(2b) "Energy-consuming system" includes but is not limited to any of the following equipment or measures:

a. Equipment used to heat, cool, or ventilate the facility;
b. Equipment used to heat water in the facility;
c. Lighting systems;
d. On-site equipment used to generate electricity for the facility;
e. On-site equipment that uses the sun, wind, oil, natural gas, liquid propane gas, coal, or electricity as a power source; and
f. Energy conservation measures, as defined in G.S. 143-64.17, in the facility design and construction that decrease the energy, water, or other utility requirements of the facility.

(3) "Facility" means a building or a group of buildings served by a central distribution system for energy, water, or other utility or components of a central distribution system.
(4) "Initial cost" means the required cost necessary to construct or renovate a facility.
(5) "Life-cycle cost analysis" means an analytical technique that considers certain costs of owning, using, and operating a facility over its economic life, including but not limited to:
a. Initial costs;
b. System repair and replacement costs;
c. Maintenance costs;
d. Operating costs, including energy costs; and
e. Salvage value.
(6) Repealed by Session Laws 1993, c. 334, s. 3, effective July 13, 1993.
(7) "State agency" means the State of North Carolina or any board, bureau, commission, department, institution, or agency of the State.
(8) "State-assisted facility" means a facility constructed or renovated in whole or in part with State funds or with funds guaranteed or insured by a State agency.
(9) "State facility" means a facility constructed or renovated, by a State agency.
(10) "State institution of higher learning" means any constituent institution of The University of North Carolina. (1975, c. 434, s. 2; 1989, c. 23, s. 1; 1993, c. 334, s. 3; 2001-415, s. 2; 2006-190, ss. 9, 10, 11; 2007-546, s. 3.1(c); 2009-446, s. 1(f); 2013-360, s. 15.22(o); 2015-241, s. 14.30(u).)

§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually.

Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office a biennial written report of utility consumption and costs. Management plans submitted biennially by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.
(2) The cost of analyzing the projected energy savings.
(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.
(4) An analysis that identifies projected annual energy savings and estimated payback periods.

(a1) State agencies and State institutions of higher learning shall carry out the construction and renovation of facilities in such a manner as to further the policy set forth under this section and to ensure the use of life-cycle cost analyses and practices to conserve energy, water, and other utilities.

(b) The Department of Administration shall develop and implement policies, procedures, and standards to ensure that State purchasing practices improve efficiency regarding energy, water, and other utility use and take the cost of the product over the economic life of the product into consideration. The Department of Administration shall adopt and implement Building Energy Design Guidelines. These guidelines shall include energy-use goals and standards, economic assumptions for life-cycle cost analysis, and other criteria on building systems and technologies. The Department of Administration shall modify the design criteria for construction and renovation of facilities of State buildings and State institutions of higher learning buildings to require that a life-cycle cost analysis be conducted pursuant to G.S. 143-64.15.

(b1) The Department of Administration, as part of the Facilities Condition and Assessment Program, shall identify and recommend energy conservation maintenance and operating procedures that are designed to reduce energy consumption within the facility of a State agency or a State institution of higher learning and that require no significant expenditure of funds. Every State agency or State institution of higher learning shall implement these recommendations. Where energy management equipment is proposed for any facility of a State agency or of a State institution of higher learning, the maximum interchangeability and compatibility of equipment components shall be required. As part of the Facilities Condition and Assessment Program under this section, the Department of

Administration, in consultation with the State Energy Office, shall develop an energy audit and a procedure for conducting energy audits. Every five years the Department shall conduct an energy audit for each State agency or State institution of higher learning, and the energy audits conducted shall serve as a preliminary energy survey. The State Energy Office shall be responsible for system-level detailed surveys.

(b2) The Department of Administration shall submit a report of the energy audit required by subsection (b1) of this section to the affected State agency or State institution of higher learning and to the State Energy Office. The State Energy Office shall review each audit and, in consultation with the affected State agency or State institution of higher learning, incorporate the audit findings and recommendations into the management plan required by subsection (a) of this section.

(c) through (g) Repealed by Session Laws 1993, c. 334, s. 4.

(h) When conducting a facilities condition and assessment under this section, the Department of Administration shall identify and recommend to the State Energy Office any facility of a State agency or State institution of higher learning as suitable for building commissioning to reduce energy consumption within the facility or as suitable for installing an energy savings measure pursuant to a guaranteed energy savings contract under Part 2 of this Article.

(i) Consistent with G.S. 150B-2(8a)h., the Department of Administration may adopt architectural and engineering standards to implement this section.

(j) The State Energy Office shall submit a report by December 1 of every odd-numbered year to the Joint Legislative Energy Policy Commission, the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division describing the comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning required by subsection (a) of this section. The report shall also contain the following:

(1) A comprehensive overview of how State agencies and State institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains.

(2) Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed.

(3) A summary of the State agency and State institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section.

(4) A list of the State agencies and State institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the State agencies and State institutions of higher learning that received an energy audit.

(5) Any recommendations on how management plans can be better managed and implemented. (1975, c. 434, s. 3; 1993, c. 334, s. 4; 2000-140, s. 76(f); 2001-415, s. 3; 2006-190, s. 12; 2007-546, s. 3.1(a); 2008-198, s.

11.1; 2009-446, s. 1(e); 2010-31, s. 14.3; 2010-196, s. 2; 2013-360, s. 15.22(p); 2014-120, s. 55; 2015-241, s. 14.30(u); 2017-57, s. 14.1(f).)

§ 143-64.13: Repealed by Session Laws 1993, c. 334, s. 5.

§ 143-64.14: Recodified as § 143-64.16 by Session Laws 1993, c. 334, s. 7.

§ 143-64.15. Life-cycle cost analysis.

(a) A life-cycle cost analysis shall be commenced at the schematic design phase of the construction or renovation project, shall be updated or amended as needed at the design development phase, and shall be updated or amended again as needed at the construction document phase. A life-cycle cost analysis shall include, but not be limited to, all of the following elements:

(1) The coordination, orientation, and positioning of the facility on its physical site.
(2) The amount and type of fenestration and the potential for daylighting employed in the facility.
(3) Thermal characteristics of materials and the amount of insulation incorporated into the facility design.
(4) The variable occupancy and operating conditions of the facility, including illumination levels.
(5) Architectural features that affect the consumption of energy, water, and other utilities.

(b) The life-cycle cost analysis performed for any State facility shall, in addition to the requirements set forth in subsection (a) of this section, include, but not be limited to, all of the following:

(1) An energy-consumption analysis of the facility's energy-consuming systems in accordance with the provisions of subsection (g) of this section.
(2) The initial estimated cost of each energy-consuming system being compared and evaluated.
(3) The estimated annual operating cost of all utility requirements.
(4) The estimated annual cost of maintaining each energy-consuming system.
(5) The average estimated replacement cost for each system expressed in annual terms for the economic life of the facility.

(c) Each entity shall conduct a life-cycle cost analysis pursuant to this section for the construction or the renovation of any State facility or State-assisted facility of 20,000 or more gross square feet. For the replacement of heating, ventilation, and air-conditioning equipment in any State facility or State-assisted facility of 20,000 or more gross square feet, the entity shall conduct a life-cycle cost analysis of the replacement equipment pursuant to this section when the replacement is financed under a guaranteed energy savings contract or financed using repair and renovation funds.

(d) The life-cycle cost analysis shall be certified by a registered professional engineer or bear the seal of a North Carolina registered architect, or both. The engineer or architect shall be particularly qualified by training and experience for the type of work involved, but shall not be employed directly or indirectly by a fuel provider, utility company, or group supported by fuel providers or utility funds. Plans and specifications for facilities involving public funds shall be designed in conformance with the provisions of G.S. 133-1.1.

(e) In order to protect the integrity of historic buildings, no provision of this Article shall be interpreted to require the implementation of measures to conserve energy, water, or other utility use that conflict with respect to any property eligible for, nominated to, or entered on the National Register of Historic Places, pursuant to the National Historic Preservation Act of 1966, P.L. 89-665; any historic building located within an historic district as provided in Chapters 160A or 153A of the General Statutes; any historic building listed, owned, or under the jurisdiction of an historic properties commission as provided in Chapter 160A or 153A; nor any historic property owned by the State or assisted by the State.

(f) Each State agency shall use the life-cycle cost analysis over the economic life of the facility in selecting the optimum system or combination of systems to be incorporated into the design of the facility.

(g) The energy-consumption analysis of the operation of energy-consuming systems utilities in a facility shall include, but not be limited to, all of the following:

(1) The comparison of two or more system alternatives.
(2) The simulation or engineering evaluation of each system over the entire range of operation of the facility for a year's operating period.
(3) The engineering evaluation of the consumption of energy, water, and other utilities of component equipment in each system considering the operation of such components at other than full or rated outputs. (1993, c. 334, s. 6; 2001-415, ss. 4, 5; 2006-190, s. 13; 2007-546, s. 4.1.)

§ 143-64.15A. Certification of life-cycle cost analysis.

Each State agency and each State institution of higher learning performing a life-cycle cost analysis for the purpose of constructing or renovating any facility shall, prior to selecting a design option or advertising for bids for construction, submit the life-cycle cost analysis to the Department for certification at the schematic design phase and again when it is updated or amended as needed in accordance with G.S. 143-64.15. The Department shall review the material submitted by the State agency or State institution of higher learning, reserve the right to require an agency or institution to complete additional analysis to comply with certification, perform any additional analysis, as necessary, to comply with G.S. 143-341(11), and require that all construction or renovation conducted by the State agency or State institution of higher learning comply with the certification issued by the Department. (2001-415, s. 6; 2007-546, s. 4.2.)

§ 143-64.16. Application of Part.

The provisions of this Part shall not apply to municipalities or counties, nor to any agency or department of any municipality or county; provided, however, this Part shall apply to any board of a community college. Community college is defined in G.S. 115D-2(2). (1975, c. 434, s. 5; 1989, c. 23, s. 2; 1993, c. 334, s. 7; 1993 (Reg. Sess., 1994), c. 775, s. 2.)

Part 2. Energy Saving Measures for Governmental Units.

§ 143-64.17. Definitions.

As used in this Part:

(1) "Energy conservation measure" means a facility or meter alteration, training, or services related to the operation of the facility or meter, when the alteration, training, or services provide anticipated energy savings or

capture lost revenue. Energy conservation measure includes any of the following:

a. Insulation of the building structure and systems within the building.

b. Storm windows or doors, caulking, weatherstripping, multiglazed windows or doors, heat-absorbing or heat-reflective glazed or coated window or door systems, additional glazing, reductions in glass area, or other window or door system modifications that reduce energy consumption.

c. Automatic energy control systems.

d. Heating, ventilating, or air-conditioning system modifications or replacements.

e. Replacement or modification of lighting fixtures to increase the energy efficiency of a lighting system without increasing the overall illumination of a facility, unless an increase in illumination is necessary to conform to the applicable State or local building code or is required by the light system after the proposed modifications are made.

f. Energy recovery systems.

g. Cogeneration systems that produce steam or forms of energy such as heat, as well as electricity, for use primarily within a building or complex of buildings.

h. Repealed by Session Laws 2006-190, s. 2, effective August 3, 2006, and applicable to contracts entered into or renewed on or after that date.

i. Faucets with automatic or metered shut-off valves, leak detection equipment, water meters, water recycling equipment, and wastewater recovery systems.

j. Other energy conservation measures that conserve energy, water, or other utilities.

(2) "Energy savings" means a measured reduction in fuel costs, energy costs, water costs, stormwater fees, other utility costs, or operating costs, including environmental discharge fees, water and sewer maintenance fees, and increased meter accuracy, created from the implementation of one or more energy conservation measures when compared with an established baseline of previous costs, including captured lost revenues, developed by the governmental unit.

(2a) "Governmental unit" means either a local governmental unit or a State governmental unit.

(3) "Guaranteed energy savings contract" means a contract for the evaluation, recommendation, or implementation of energy conservation measures, including the design and installation of equipment or the repair or replacement of existing equipment or meters, in which all payments, except obligations on termination of the contract before its expiration, are to be made over time, and in which energy savings are guaranteed to exceed costs.

(4) "Local governmental unit" means any board or governing body of a political subdivision of the State, including any board of a community

college, any school board, or an agency, commission, or authority of a political subdivision of the State.

(5) "Qualified provider" means a person or business experienced in the design, implementation, and installation of energy conservation measures who has been prequalified by the State Energy Office according to the prequalification criteria established by that Office.

(5a) "Qualified reviewer" means an architect or engineer who is (i) licensed in this State and (ii) experienced in the design, implementation, and installation of energy efficiency measures.

(6) "Request for proposals" means a negotiated procurement initiated by a governmental unit by way of a published notice that includes the following:

a. The name and address of the governmental unit.
b. The name, address, title, and telephone number of a contact person in the governmental unit.
c. Notice indicating that the governmental unit is requesting qualified providers to propose energy conservation measures through a guaranteed energy savings contract.
d. The date, time, and place where proposals must be received.
e. The evaluation criteria for assessing the proposals.
f. A statement reserving the right of the governmental unit to reject any or all the proposals.
g. Any other stipulations and clarifications the governmental unit may require.

(7) "State governmental unit" means the State or a department, an agency, a board, or a commission of the State, including the Board of Governors of The University of North Carolina and its constituent institutions. (1993 (Reg. Sess., 1994), c. 775, s. 3; 1995, c. 295, s. 1; 1999-235, ss. 1, 2; 2002-161, s. 2; 2006-190, s. 2; 2013-396, s. 1.)

§ 143-64.17A. Solicitation of guaranteed energy savings contracts.

(a) RFP Issuance. – Before entering into a guaranteed energy savings contract, a governmental unit shall issue a request for proposals. Notice of the request shall be published at least 15 days in advance of the time specified for opening of the proposals in at least one newspaper of general circulation in the geographic area for which the local governmental unit is responsible or, in the case of a State governmental unit, in which the facility or facilities are located. No guaranteed energy savings contract shall be awarded by any governmental unit unless at least two proposals have been received from qualified providers. Provided that if after the publication of the notice of the request for proposals, fewer than two proposals have been received from qualified providers, or fewer than two qualified providers attend the mandatory prebid meeting, the governmental unit may then open the proposals and select a qualified provider even if only one proposal is received.

(b) Preliminary Proposal Evaluation. – The governmental unit shall evaluate a sealed proposal from any qualified provider. A qualified reviewer shall be required to evaluate the proposals and will provide the governmental unit with a letter report containing both qualitative and quantitative evaluation of the proposals. The report may include a recommendation for selection, but the governmental unit is not obligated to follow it.

(c) Receipt of Proposals for Unit of Local Government. – In the case of a local governmental unit, proposals received pursuant to this section shall be opened by a member or an employee of the governing body of the local governmental unit at a public opening at which the contents of the proposals shall be announced and recorded in the minutes of the governing body. Proposals shall be evaluated for the local governmental unit by a qualified reviewer on the basis of:

(1) The information required in subsection (b) of this section; and

(2) The criteria stated in the request for proposals.

The local governmental unit may require a qualified provider to include in calculating the cost of a proposal for a guaranteed energy savings contract any reasonable fee payable by the local governmental unit for the evaluation of the proposal by a qualified reviewer not employed as a member of the staff of the local governmental unit or the qualified provider.

(c1) Receipt of Proposals for Unit of State Government. – In the case of a State governmental unit, proposals received pursuant to this section shall be opened by a member or an employee of the State governmental unit at a public opening and the contents of the proposals shall be announced at this opening. Proposals shall be evaluated for the State governmental unit by a qualified reviewer who is either privately retained, employed with the Department of Administration, or employed as a member of the staff of the State governmental unit. The proposal shall be evaluated on the basis of the information and report required in subsection (b) of this section and the criteria stated in the request for proposals.

The State governmental unit shall require a qualified provider to include in calculating the cost of a proposal for a guaranteed energy savings contract any reasonable fee payable by the State governmental unit for evaluation of the proposal by a qualified reviewer not employed as a member of the staff of the State governmental unit or the qualified provider. The Department of Administration may charge the State governmental unit a reasonable fee for the evaluation of the proposal if the Department's services are used for the evaluation and the cost paid by the State governmental unit to the Department of Administration shall be calculated in the cost of the proposal under this subsection.

(d) Criteria for Selection of Provider. – The governmental unit shall select the qualified provider that it determines to best meet the needs of the governmental unit by evaluating all of the following and following the procedures set forth in subsection (d1) of this section:

(1), (2) Repealed by Session Laws 2013-396, s. 2, effective August 23,2013.

(3) Quality of the products and energy conservation measures proposed.

(4) Repealed by Session Laws 2013-396, s. 2, effective August 23, 2013.

(5) General reputation and performance capabilities of the qualified providers.

(6) Substantial conformity with the specifications and other conditions set forth in the request for proposals.
(7) Time specified in the proposals for the performance of the contract.
(8) Any other factors the governmental unit deems necessary, which factors shall be made a matter of record.

(d1) Process for Selection of Provider. – The governmental unit shall select a short list of finalists on the basis of its rankings of the written proposals under the criteria set forth in subsection (d) of this section as well as references from past clients. The governmental unit shall have the highest ranked qualified provider prepare a cost-savings analysis for the proposed contract showing at a minimum a comparison of the total estimated project savings to the total estimated project costs for the proposed term. If the governmental unit and the qualified provider cannot negotiate acceptable terms, pricing, and savings estimates, the governmental unit may terminate the process and begin negotiations with the second highest ranked qualified provider. The State Energy Office shall review the selected qualified provider's proposal, cost-benefit analysis, and other relevant documents prior to the governmental unit announcing the award.

(e) Nothing in this section shall limit the authority of governmental units as set forth in Article 3D of this Chapter. (1993 (Reg. Sess., 1994), c. 775, s. 3; 2002-161, s. 3; 2013-396, s. 2.)

§ 143-64.17B. Guaranteed energy savings contracts.

(a) A governmental unit may enter into a guaranteed energy savings contract with a qualified provider if all of the following apply:

(1) The term of the contract does not exceed 20 years from the date of the installation and acceptance by the governmental unit of the energy conservation measures provided for under the contract.
(2) The governmental unit finds that the energy savings resulting from the performance of the contract will equal or exceed the total cost of the contract.
(3) The energy conservation measures to be installed under the contract are for an existing building or utility system, or utility consuming device or equipment when the utility cost is paid by the governmental unit.

(b) Before entering into a guaranteed energy savings contract, the governmental unit shall provide published notice of the time and place or of the meeting at which it proposes to award the contract, the names of the parties to the proposed contract, and the contract's purpose. The notice must be published at least 15 days before the date of the proposed award or meeting.

(c) A qualified provider entering into a guaranteed energy savings contract under this Part shall provide security to the governmental unit in the form acceptable to the Office of the State Treasurer and in an amount equal to one hundred percent (100%) of the guaranteed savings for the term of the guaranteed energy savings contract to assure the provider's faithful performance. Any bonds required by this subsection shall be subject to the provisions of Article 3 of Chapter 44A of the General Statutes. If the savings resulting from a guaranteed energy savings contract are not as great as projected under the contract and all required shortfall payments to the governmental unit have not been made, the governmental unit may terminate the contract without incurring any additional obligation to the qualified provider.

(d) As used in this section, "total cost" shall include, but not be limited to, costs of construction, costs of financing, and costs of maintenance and training during the term of the contract less the application of the utility company, State, or federal incentives, grants, or rebates. "Total cost" does not include any obligations on termination of the contract before its expiration, provided that those obligations are disclosed when the contract is executed.

(e) A guaranteed energy savings contract may not require the governmental unit to purchase a maintenance contract or other maintenance agreement from the qualified provider who installs energy conservation measures under the contract if the unit of government takes appropriate action to budget for its own forces or another provider to maintain new systems installed and existing systems affected by the guaranteed energy savings contract.

(f) In the case of a State governmental unit, a qualified provider shall, when feasible, after the acceptance of the proposal of the qualified provider by the State governmental unit, conduct an investment grade audit. During this investment grade audit, the qualified provider shall perform in accordance with Part 1 of this Article a life cycle cost analysis of each energy conservation measure in the final proposal. If the results of the audit are not within ten percent (10%) of both the guaranteed savings contained in the proposal and the total proposal amount, either the State governmental unit or the qualified provider may terminate the project without incurring any additional obligation to the other party. However, if the State governmental unit terminates the project after the audit is conducted and the results of the audit are within ten percent (10%) of both the guaranteed savings contained in the proposal and the total proposal amount, the State governmental unit shall reimburse the qualified provider the reasonable cost incurred in conducting the audit, and the results of the audit shall become the property of the State governmental unit.

(g) A qualified provider shall provide an annual reconciliation statement based upon the results of the measurement and verification review. The statement shall disclose any shortfalls or surplus between guaranteed energy and operational savings specified in the guaranteed energy savings contract and actual, not stipulated, energy and operational savings incurred during a given guarantee year. Any guaranteed energy and operational savings shall be determined by using one of the measurement and verification methodologies listed in the United States Department of Energy's Measurement and Verification Guidelines for Energy Savings Performance Contracting, the International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization, or Guideline 14-2002 of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers. If due to existing data limitations or the nonconformance of specific project characteristics, none of the three methodologies listed in this subsection is sufficient for measuring guaranteed savings, the qualified provider shall develop an alternate method that is compatible with one of the three methodologies and mutually agreeable to the governmental unit. The guarantee year shall consist of a 12-month term commencing from the time that the energy conservation measures become fully operational. A qualified provider shall pay the governmental unit or its assignee any shortfall in the guaranteed energy and operational savings after the total year savings have been determined. In the case of a governmental unit, a surplus in any one year shall not be carried forward or applied to a shortfall in any other year. (1993 (Reg. Sess., 1994), c. 775, s. 3; 1995, c. 295, s. 2; 1999-235, s. 3; 2002-161, s. 4; 2003-138, s. 1; 2006-190, s. 3; 2009-375, s. 2; 2013-396, s. 3; 2014-115, s. 56.7.)

§ 143-64.17C: Repealed by Session Laws 2002, ch. 161, s. 5, effective January 1, 2003, and applicable to contracts entered into on or after that date.

§ 143-64.17D. Contract continuance.

A guaranteed energy savings contract may extend beyond the fiscal year in which it becomes effective. Such a contract shall stipulate that it does not constitute a direct or indirect pledge of the taxing power or full faith and credit of any governmental unit. (1993 (Reg. Sess., 1994), c. 775, s. 3; 2002-161, s. 6.)

§ 143-64.17E. Payments under contract.

A local governmental unit may use any funds, whether operating or capital, that are not otherwise restricted by law for the payment of a guaranteed energy savings contract. State appropriations to any local governmental unit shall not be reduced as a result of energy savings occurring as a result of a guaranteed energy savings contract. (1993 (Reg. Sess., 1994), c. 775, s. 3.)

§ 143-64.17F. State agencies to use contracts when feasible; rules; recommendations.

(a) State governmental units shall evaluate the use of guaranteed energy savings contracts in reducing energy costs and may use those contracts when feasible and practical.

(b) The Department of Administration, in consultation with the Department of Environmental Quality, through the State Energy Office, shall adopt rules for: (i) agency evaluation of guaranteed energy savings contracts; (ii) establishing time periods for consideration of guaranteed energy savings contracts by the Office of State Budget and Management, the Office of the State Treasurer, and the Council of State, and (iii) setting measurements and verification criteria, including review, audit, and precertification. Prior to adopting any rules pursuant to this section, the Department shall consult with and obtain approval of those rules from the State Treasurer. The rules adopted pursuant to this subsection shall not apply to energy conservation measures implemented pursuant to G.S. 143-64.17L.

(c) The Department of Administration, and the Department of Environmental Quality through the State Energy Office, may provide to the Council of State its recommendations concerning any energy savings contracts being considered. (2002-161, s. 7; 2003-138, s. 2; 2009-446, s. 1(d); 2011-145, s. 9.6D(d); 2013-360, s. 15.22(d); 2015-241, s. 14.30(u).)

<u>§ 143-64.17G. Report on guaranteed energy savings contracts entered into by local governmental units.</u>

A local governmental unit that enters into a guaranteed energy savings contract must report the contract and the terms of the contract to the Local Government Commission and the State Energy Office of the Department of Environmental Quality. The Commission shall compile the information and report it biennially to the Joint Commission on Governmental Operations. In compiling the information, the Local Government Commission shall include information on the energy savings expected to be realized from a contract and, with the assistance of the Office of State Construction and the State Energy Office, shall evaluate whether expected savings have in fact been realized. (1993 (Reg. Sess., 1994), c. 775, s. 9; 2006-190, s. 4; 2009-375, s. 3; 2013-360, s. 15.22(e); 2015-241, s. 14.30(u).)

<u>§ 143-64.17H. Report on guaranteed energy savings contracts entered into by State governmental units.</u>

A State governmental unit that enters into a guaranteed energy savings contract or implements an energy conservation measure pursuant to G.S. 143-64.17L must report either (i) the contract and the terms of the contract or (ii) the implementation of the measure to the State Energy Office of the Department of Environmental Quality within 30 days of the date the contract is entered into or the measure is implemented. In addition, within 60 days after each annual anniversary date of a guaranteed energy savings contract, the State governmental unit must report the status of the contract to the State Energy Office, including any details required by the State Energy Office. The State Energy Office shall compile the information for each fiscal year and report it to the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, the Fiscal Research Division, and the Local Government Commission annually by December 1. In compiling the information, the State Energy Office shall include information on the energy savings expected to be realized from a contract or implementation and shall evaluate whether expected savings have in fact been realized. (2002-161, s. 8; 2006-190, s. 5; 2009-446, s. 1(c); 2011-145, s. 9.6D(e); 2013-360, s. 15.22(f); 2015-241, s. 14.30(u); 2017-57, s. 14.1(g).)

§ 143-64.17I. Installment and lease purchase contracts.

A local governmental unit may provide for the acquisition, installation, or maintenance of energy conservation measures acquired pursuant to this Part by installment or lease purchase contracts in accordance with and subject to the provisions of G.S. 160A-20 and G.S. 160A-19, as applicable. (2002-161, s. 8.)

§ 143-64.17J. Financing by State governmental units.

State governmental units may finance the acquisition, installation, or maintenance of energy conservation measures acquired pursuant to this Part in the manner and to the extent set forth in Article 8 of Chapter 142 of the General Statutes or as otherwise authorized by law. (2002-161, s. 8.)

§ 143-64.17K. Inspection and compliance certification for State governmental units.

The provisions of G.S. 143-341(3) shall not apply to any energy conservation measure for State governmental units provided pursuant to this Part, except as specifically set forth in this section. Except as otherwise exempt under G.S. 116-31.11, the following shall apply to all energy conservation measures provided to State governmental units pursuant to this Part:

(1) The provisions of G.S. 133-1.1.

(2) Inspection and certification by:

a. The applicable local building inspector under Part 4 of Article 18 of Chapter 153A of the General Statutes or Part 5 of Article 19 of Chapter 160A of the General Statutes; or

b. At the election of the State governmental unit, the Department of Administration under G.S. 143-341(3)d.

The cost of compliance with this section may be included in the cost of the project in accordance with G.S. 143-64.17A(c1) and may be included in the cost financed under Article 8 of Chapter 142 of the General Statutes. (2002-161, s. 8.)

§ 143-64.17L. Board of Governors may authorize energy conservation measures at constituent institutions.

(a) Authority. – Notwithstanding the provisions of this Part to the contrary, the Board of Governors of The University of North Carolina may authorize any constituent institution listed in subsection (e) of this section to implement an energy conservation measure without entering into a guaranteed energy savings contract if both of the following conditions are met:

(1) The Board of Governors finds that the energy savings resulting from the implementation of the energy conservation measure shall, according to the energy savings analysis received pursuant to G.S. 143-64.17M(a), equal or exceed the total cost of implementing the measure. If the proposed implementation will be financed with debt, then the energy savings analysis must project sufficient energy savings to pay the debt service on any bonds to be issued. As used in this subdivision, the term "total cost' shall have the same meaning as it does in G.S. 143-64.17B(d).

(2) The energy conservation measure is for an existing building or utility system.

(b) Scope of Authority. – In implementing an energy conservation measure pursuant to subsection (a) of this section, the Board of Governors may undertake or authorize any constituent institution listed in subsection (e) of this section to undertake any action that (i) could be required of a qualified provider under a guaranteed energy savings contract or (ii) is otherwise permissible under this Part.

(c) Projects Consisting of Multiple Energy Conservation Measures. – The Board of Governors may authorize the implementation of multiple energy conservation measures simultaneously as part of a single project. When doing so, the findings required by subsection (a) of this section may be made with respect to the project as a whole and need not be made with respect to individual energy conservation measures. Similarly, the analyses required by G.S. 143-64.17M may be conducted for the project as a whole instead of for individual energy conservation measures.

(d) Continuing Applicability of Part to Contracts. – If the Board of Governors or a constituent institution implements an energy conservation measure through a guaranteed energy savings contract, that contract shall accord in all respects with the requirements of this Part.

(e) The Board of Governors may authorize North Carolina State University and the University of North Carolina at Charlotte to implement an energy conservation measure without entering into a guaranteed energy savings contract pursuant to this section. (2011-145, s. 9.6D(a); 2013-396, s. 4(a).)

§§ 143-64.17L through 143-64.19. Reserved for future codification purposes.

§ 143-64.17M. Energy savings analysis required prior to implementation; post-implementation analyses required.

(a) Energy Savings Analysis Required Prior to Implementation. – Prior to implementing an energy conservation measure pursuant to G.S. 143-64.17L, an energy savings analysis shall be performed to validate the economic assumptions that purportedly support the implementation of the measure. This analysis shall be performed by a third party selected by the constituent institution and shall include an energy consumption analysis to develop a baseline of previous costs of all utilities' energy consumption for the institution on the assumption that the energy conservation measure was not undertaken. The completed analysis shall be submitted to The University of North Carolina System Office and to the State Energy Office.

(b) Post-Implementation Analyses Required. – A constituent institution that implements an energy conservation measure pursuant to G.S. 143-64.17L shall retain a third party to perform an annual measurement and verification of energy savings resulting from the energy conservation measure as compared to the baseline of previous costs set forth in the energy savings analysis required by subsection (a) of this section. The third party shall annually provide a reconciliation statement based upon the results of a preagreed upon measurement, monitoring, and verification protocol which shall disclose any shortfall or surplus between the estimated energy usage and operational savings set forth in the energy savings analysis required by subsection (a) of this section and actual, not stipulated, energy usage and operational savings incurred during a given year.

If a reconciliation statement reveals a shortfall in energy savings for a particular year, the constituent institution shall be responsible for and shall pay the shortfall. However, the institution shall not be held responsible for losses due to natural disasters or other emergencies. Any surplus shall be retained by the institution and may be used in the same manner as any other energy savings. (2011-145, s. 9.6D(b); 2018-12, s. 17.)

North Carolina Division of Employment Security

Appendix – 4
Energy Mandate for the North Carolina Division of Employment Security

The undersigned recognize that our utilities usage is a controllable expense in which reductions can be allocated to other needs within our operations budget, and that energy efficiency is the responsibility of all staff.

- The development and implementation of this Strategic Energy Plan is the responsibility of the undersigned Utilities Manager.
- The undersigned directors will support this Plan and report on progress annually.

Energy Mandate - Goal

The goal of this Plan is to reduce the annual total energy consumption per square foot of this complex to 40% below 2002-2003 levels.

Energy Mandate – Tracking Measures

- *Total Utilities use and cost per square foot*
- *Electric KWH use per square foot*
- *Gas BTU use per square foot*
- *Water use per square foot*

Energy Mandate – Commitment

1 March, 2021

Pryor Gibson	*Kevin Carlson*	*Joseph Katzberg*
Assistant Secretary	Chief Financial Officer	*Director of* Support Services

This **Energy Mandate** serves as a **Memorandum of Agreement** to support Strategic Energy Planning for state government as mandated in General Statutes 143-64.10 & 12.

This Energy Mandate serves as a Memorandum of Agreement to support Executive Order 80 effective 29 October, 2018.

Utility Management Plan

FY 2020 – FY 2021

Executive Order No. 80 Update

North Carolina Department of Environmental Quality

NCDEQ, 217 West Jones Street, Raleigh, NC 27603
Phone 877-623-6748; https://deq.nc.gov/

November 2020

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EXECUTIVE SUMMARY

The North Carolina Department of Environmental Quality (DEQ) is the lead stewardship agency for the protection of North Carolina's environmental resources. The DEQ reaches far and wide with offices from the mountains to the coast. Chief responsibilities include administering regulatory programs designed to protect air quality, water quality, and the public's health along with advancing energy efficiency. The majority of DEQ employees work in buildings owned by the Department of Administration or in leased buildings which are not included in the DEQ utility data. Only the State-owned facilities currently managed by DEQ are measured and tracked for the DEQ utility data. These facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. Mr. Eric Turon, based in Raleigh, is the DEQ Facilities Engineering Manager who champions all the energy conservation projects for both Reedy Creek and DMF. That encompasses a total of 99,335 gross square feet (GSF) of facilities and amounts to $424,607 total spent on utilities for fiscal year 2019-20.

The DEQ presents this Utility Management Plan in accordance with Article 3B of General Statute 143, “Conservation of Energy, Water, and Other Utilities in Government Facilities,” which authorizes DEQ to develop a comprehensive program to manage energy, water and other utility use for state government. Each agency is to develop and implement a management plan including strategies to support stated energy reduction goals, and update plans biennially. The first plan was issued Mar. 1, 2019 as mandated by Governor Cooper’s Executive Order No. 80 (EO80), North Carolina’s Commitment to Address Climate Change and Transition to a Clean Energy Economy dated October 29, 2018. This document will serve as the March 1, 2021 update. EO80 Section 8 requires Cabinet agencies to implement strategies to support a new energy consumption reduction goal of 40% by 2025. This goal surpasses the previous goal to reduce energy consumption in state government buildings 30% by 2015 as measured from a fiscal year (FY) 2002-03 baseline.

This updated utility management plan presents the recorded utility data along with strategies to achieve continued success in energy and water management for DEQ state-owned facilities both at Reedy Creek in Raleigh, and the Division of Marine Fisheries in Morehead City. Many DEQ employees work in buildings owned by the Department of Administration, or in leased buildings, which are not included in the utilities scope of this management plan. However, DEQ occupants which are considered tenants in buildings owned or leased by the state can make significant contributions to energy and water savings efforts through awareness and behavior, contributing toward the goals in EO80.

Last year, DEQ assumed responsibilities of the Maintenance Operations for the Reedy Creek complex from DOA. Since that time, DEQ has repaired and replaced a significant amount of equipment that was previously not running nor operable. For that reason, their energy usage has increased slightly from FY 2018-19 to FY 2019-20. However, some significant energy conservation projects have taken place and are planned. These include cool, white roofs, building automation systems, new HVAC systems, LED lighting upgrades, and electric vehicle chargers. Although DEQ is currently only showing a 32% energy reduction from their FY 2010-11 baseline, these projects will enable DEQ to meet the 40% energy reduction by 2025 as required with EO 80. Even though DEQ may reflect a relatively small footprint as compared to other cabinet agencies, DEQ is making great strides with energy conservation. The next few years should start to show the results of these improvements.

BACKGROUND

Efforts to measure and track energy use and cost in state buildings was highlighted in 2002 with the launch of the state's comprehensive program, the Utility Savings Initiative, pursuant to N.C.G.S. 143-64.10-12. At that time DEQ was known as the Department of Environment and Natural Resources (DENR.) DENR owned a few large buildings and a multitude of small buildings widely distributed across the state and across several divisions, including the NC Zoo, Parks and Recreation, and the NC Aquariums. Due to legislative changes in 2015, DENR was dismantled and now exists separately as the Department of Natural and Cultural Resources (DNCR) and the DEQ. That change effectively reduced DEQ's stock of buildings down to only two facilities. These two current DEQ facilities include the Reedy Creek complex located in Raleigh which is primarily occupied by the Divisions of Air Quality and Water Resources along with the Division of Marine Fisheries (DMF) located in Morehead City. The Reedy Creek Laboratory Complex consists of three buildings constructed in 1991 along with two modular buildings with 54,304 sq. ft. of laboratory and office space. The DMF consists of four State owned facilities totaling 45,031 square feet of office space. The overall total area DEQ comprises is 99,335 gross square feet.

In order to reflect the gross square footage changes and restructuring more accurately, an attempt was made to separate utility and square footage data back to the original FY 2002-03 baseline, but lack of data at the division and building level proved to be an overwhelming task. Therefore, new baselines of FY 2010-11 were established for both DEQ and DNCR. The applicable utility and square footage data were separated and divided between the two agencies according to the relative composition of each agency today. This allows the overall energy reduction of each agency to be reflected and accounted for against a baseline that more closely resembles how each agency is currently structured. Otherwise, the agencies would be trying to achieve energy reductions on square footages that no longer exist and are no longer under their control. All the utility data and calculations within this report reflect the new FY2010-11 baseline.

The DEQ Reedy Creek and DMF facilities are managed by designated "site" energy managers, also serving as Capital Projects Coordinators, who are instrumental in achieving savings through capital improvement and repair projects and maintaining savings in energy and water. These sites report usage and cost annually and update management plans biennially as contributors to this DEQ management plan.

Many DEQ employees work in buildings owned by the Department of Administration or in leased buildings, which are not included in the utility scope of this management plan. However, DEQ occupants who are tenants in buildings owned or leased by the state can still make significant contributions to energy and water savings efforts through awareness and behavior. All DEQ employees can be a part of the statewide effort to save energy and water and to address climate change. Reducing energy consumption translates to a reduction in fossil fuels burned and a decrease in air pollution emitted. Water conservation is also becoming an increasingly important issue particularly during drought conditions.

UTILITY PERFORMANCE

The following tables present the energy, water, and performance data of the current DEQ facilities per GSF of building space for the Reedy Creek and Marine Fisheries locations combined using a baseline year of FY 2010-11. Table 1 shows the total amount spent on each utility along with the utility and energy cost per square feet. Utility costs include water and sewer whereas energy costs only include electricity and fuels. Per this data, electric is by far the major consumer followed by natural gas and water/sewer. Overall spending is reduced from the baseline but has increased over the past couple of years. This can be attributed to the work Reedy Creek has done to reinstate and replace a significant amount of non-operational equipment over the past couple of years.

Table 2 shows the DEQ energy reduction performance annually from the FY10-11 baseline. The EO80 goal is a 40% reduction, and DEQ currently stands at a 32% reduction. Although energy usage has increased over the past couple of years as Reedy Creek has improved and replaced inoperable equipment, the projects currently being installed and proposed should help them to attain the overall 40% reduction by 2025. Also of note is that approximately half of the DEQ space is used for laboratories which normally have a high energy use per square foot of space compared to a typical office. More detailed tables are available in the Appendix.

Table 1: DEQ Utility Cost Details

Fiscal year	Total Utility $	Total Energy $	Electric kwh $	Nat Gas $	Propane $	Water-sewer $	Total Utility $/GSF	Total Energy $/GSF	GSF
10-11	$572,246	$550,833	$428,428	$118,893	$ 3,512	$21,413	$5.42	$5.22	105,527
11-12	$502,132	$480,275	$372,292	$107,974	$ 8	$21,857	$4.76	$4.55	105,527
12-13	$444,867	$419,839	$363,472	$ 54,739	$ 1,628	$25,029	$4.22	$3.98	105,527
13-14	$485,174	$456,367	$384,948	$ 69,258	$ 2,161	$28,808	$4.60	$4.32	105,527
14-15	$470,151	$437,491	$370,135	$ 64,109	$ 3,247	$32,600	$4.46	$4.15	105,527
15-16	$393,311	$359,980	$302,288	$ 56,711	$ 981	$33,331	$3.73	$3.41	105,527
16-17	$373,231	$335,429	$277,124	$ 55,860	$ 2,445	$37,802	$3.54	$3.18	105,527
17-18	$341,919	$303,618	$236,851	$ 65,822	$ 945	$38,301	$2.82	$2.50	121,397
18-19	$378,914	$338,345	$280,824	$ 56,109	$ 1,411	$40,569	$3.81	$3.41	99,335
19-20	$424,607	$381,711	$283,710	$ 97,180	$ 822	$42,896	$4.27	$3.84	99,335

Table 2: DEQ Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	31,367,728,948	105,527	297,248	----
2011-12	28,777,710,158	105,527	272,705	-8%
2012-13	23,186,771,944	105,527	219,724	-26%
2013-14	22,477,883,549	105,527	213,006	-28%
2014-15	21,990,790,966	105,527	208,390	-30%
2015-16	22,049,504,628	105,527	208,947	-30%
2016-17	17,766,979,928	105,527	168,364	-43%
2017-18	18,432,835,063	121,397	151,839	-49%
2018-19	18,721,241,491	99,335	188,466	-37%
2019-20	19,992,304,434	99,335	201,261	-32%

DIVISION OF MARINE FISHERIES

The Department of Environmental Quality (DEQ), Division of Marine Fisheries (DMF) consists of four state owned facilities totaling 45,031 square feet located in Carteret County, North Carolina with the main headquarters in Morehead City. DMF shares space with other state agencies at six other locations that are leased facilities throughout the eastern region of the state. None of the leased facilities are included in the utility scope of this management plan. DMF spent a total of $155,532 on utilities for the FY19-20 year.

DMF works closely with DEQ to comply with the overall department Strategic Energy Plan (SEP) and supports the initiative to reduce energy consumption by 40 percent by 2025 as directed by the Governor's Executive Order No. 80. Currently, DMF is trending in the right direction to accomplish the goal but, much depends on whether sufficient Repair and Renovation (R&R) funding is received. The replacing of equipment with more efficient types and renovating with energy conservation measures are a high priority. Educating employees to be more aware of energy savings initiatives is also vital to accomplish our goals. DMF is working with DEQ to secure grants to change out LED lights and to install EV chargers. DMF is currently at an 18% energy reduction from their FY10-11 baseline as shown in Table 3 below.

Table 3: DMF Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	7,827,451,270	45,031	173,824	----
2011-12	9,210,378,678	45,031	204,534	18%
2012-13	7,997,642,651	45,031	177,603	2%
2013-14	8,442,216,980	45,031	187,476	8%
2014-15	8,269,790,588	45,031	183,647	6%
2015-16	9,674,385,185	45,031	214,838	24%
2016-17	7,772,732,988	45,031	172,608	-1%
2017-18	8,057,443,355	45,031	178,931	3%
2018-19	7,683,608,235	45,031	170,629	-2%
2019-20	6,432,374,826	45,031	142,843	-18%

NC Division of Marine Fisheries Energy Related Projects

DMF Noteworthy Energy Related Projects Already Completed

Project Description	Cost	Funding	Estimated Savings	Completion
HVAC Chiller & Replacement	$ 161,000	R&R	$ 9,500	2014
Elevator Modernization	$ 172,000	R&R	undetermined	2015
Maintenance Building Restrooms Renovation (Emergency Project)	$ 202,596	Special Funds	undetermined	2018
Maintenance Building Roof Replacement	$ 209,000	R&R	undetermined	2019
HVAC Controls System Upgrade and Standby Generator	$ 417,000	R&R	undetermined	2019
Main Building Complex Roof Replacement	$ 463,000	R&R	undetermined	2020

DMF Proposed Energy Related Projects

Project Description	Cost	Funding	Estimated Savings	Completion
Campus LED Lighting Conversion	100000	TBD	undetermined	TBD
Installation of Electric Vehicle Chargers	30000	TBD	undetermined	TBD

Plan of Action

DMF has submitted 10 projects in the six-year plan for 2019-2025 Reserve for Repairs and Renovations (R&R) and 40 percent of those projects will have an impact on energy efficiency. DMF will continue to strive to meet energy reduction goals, but funding for R&R projects is imperative to achieve DMF's goals.

DIVISIONS OF WATER RESOURCES AND AIR QUALITY AT REEDY CREEK LABORATORY

The Reedy Creek Laboratory Complex brings together the analytical capabilities of the Division of Water Resources and the Division of Air Quality. These capabilities include chemical analysis and biological assessment for determinations of environmental quality. The Complex consists of three buildings constructed in 1991 along with two modular buildings with 54,304 sq. ft. of laboratory and office space. These structures experienced numerous problems early on with the roofs of all three buildings requiring replacement within the first ten years. Partly due to the nature of the buildings being laboratories, numerous other problems emerged as the buildings aged. The Chemistry Laboratory was plagued by serious problems with air balance within the building. Energy consumption, particularly natural gas usage, seemed to be high for the size of the buildings. Comfort of the occupants and reliable conditions within the analytical instrument requirements were inferior to what would be expected for a building this age.

A study was done in 2007 to identify the problems and to recommend steps necessary to remedy the situation. Those recommendations were translated into requests for Repair and Renovation (R&R) funding and numerous projects have been taken to improve the occupant comfort, the environment for the analytical instruments, and energy conservation measures for the complex.

In 2012, the HVAC system in the Chemistry Laboratory was renovated, a new chiller was installed serving the whole complex and numerous other measures were taken to improve safety, comfort and energy conservation. The result is a building that can be relied upon to better serve staff and to save energy.

In 2016, the boiler serving the complex was replaced as well as air handling units in the other two buildings. The HVAC controls were not replaced but are part of an additional project that is about to commence. The buildings have reliable heat and cooling, but the coordination of the controls is lacking and extremely important. In May of 2020 DEQ Facilities Services installed analytics software on the existing HVAC system controls to help troubleshoot daily operational issues as well as track energy usage.

In December 2019 DEQ created and staffed a Facilities Services Department to support fully the Lab campus 24/7. Day to day maintenance responsibilities were transferred from DOA Facilities Services (who were service fee based) over to DEQ Facilities Services. All critical infrastructure equipment was put onto a Preventative Maintenance System. Additionally, an electronic asset inventory system was implemented with all equipment assets in the process of being asset tagged and logged into the system. Since December 2019 DEQ Facilities Services has spent over $550,000 on critical infrastructure and equipment repairs to ensure lab operations experience minimal interruption of services. Some of those repairs include:

- Installation of 80 Uninterrupted Power Supplies and Surge Protection Devices on all electronic pieces of lab equipment.
- Replacement of the broken gas main and meter.
- Infra-Red and Arc Flash Analysis on all campus electrical supply system, repairs made as identified in analysis.
- Repairs to campus generator, installation of remote monitoring system.
- Several HVAC repairs.
- Analytic Software installed on HVAC controls system.
- Convert 16 broken parking lot pole lights to LED.
- Replace burned out exterior lighting to LED.

The staff at the Reedy Creek complex is committed to, and takes pride in, working with the DEQ to comply and to exceed the energy reduction goal set out by the Governor in Executive Order No. 80. We are an environmental agency and committed to reduce the environmental impact of our operations as we carry out the mission of the Department. Reedy Creek is currently at a 36% energy reduction from their FY10-11 baseline as shown in Table 4 below. Their total utility spending was $269,074 for FY19-20.

Table 4: Reedy Creek Energy Reduction Performance

Fiscal year	Total energy Btu	GSF	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	23,540,277,678	60,496	389,121	----
2011-12	19,567,331,480	60,496	323,448	-17%
2012-13	15,189,129,293	60,496	251,077	-35%
2013-14	14,035,666,569	60,496	232,010	-40%
2014-15	13,721,000,378	60,496	226,808	-42%
2015-16	12,375,119,444	60,496	204,561	-47%
2016-17	9,994,246,940	60,496	165,205	-58%
2017-18	10,375,391,708	76,366	135,864	-65%
2018-19	11,037,633,256	54,304	203,256	-48%
2019-20	13,559,929,608	54,304	249,704	-36%

NC Division of Water Resources and Air Quality-Reedy Creek Labs Projects

Reedy Creek Noteworthy Energy Related Projects Already Completed or In Progress

Project Description	Cost	Funding	Estimated Savings	Completion
HVAC Chiller Replacement & Chemistry Lab Renovations	$ 1,205,973	ARRA	$ 57,000	2012
	$ 982,000	R&R		
Boiler & Air Handler Replacement in DAQ & DWQ Buildings	$ 632,846	R&R	undetermined	2020
HVAC Renovations & DDC Controls - DAQ & DWQ Labs	$ 265,000	R&R	undetermined	Jun-21
HVAC Ductwork & VAV Box Replacements - DAQ & DWQ	$ 496,000	R&R	undetermined	Jun-21
Cooling Tower Replacement & Evaporation Credit Meter	$ 159,000	R&R	undetermined	Dec-21
Glycol Energy Loop Refurbishment - DWQ Building	$ 35,000	R&R	undetermined	2020
Campus Lighting Retrofit from T12 to LED	$ 114,000	DOE Grant	$ 20,000	2020
	$ 46,000	Duke Rebates		
Cool Roof Replacements for buildings 4401 and 4403	$ 567,000	R&R	$ 6,440	Jun-21
Reflective window blinds for entire campus	$ 14,000	Gen. Fund	undetermined	Dec-20

Reedy Creek Proposed Energy Related Projects

Project Description	Cost	Funding	Estimated Savings	Completion
Installation of Electric Vehicle Chargers	$ 30,000	TBD	undetermined	TBD

Plan of Action

The Reedy Creek Lab Complex will continue the efforts already underway to improve the energy efficiency of the buildings in the complex. We will continue to seek new ways to save energy through improvements to the buildings, their operations and their maintenance. The support provided by the Department of Environmental Quality has been and will continue to be critical for the complex to carry out its mission and set an example for environmental stewardship.

DECLARATION OF SUPPORT FOR DEPARTMENT OF ENVIRONMENTAL QUALITY UTILITY MANAGEMENT PLAN

We recognize that:

- Energy and water consumption can be managed to the benefit of our agency.
- Energy and water management is a responsibility of the staff at each facility.

This Agency will implement a Utility Management Plan. Eric Turon, Facilities Engineering Manager, is responsible for the implementation of the Program at this agency.

The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

The Division staff will review progress and results quarterly and will support staff attendance at training in energy and water management.

Utility Management Plan Mandate- Goals

Agency will reduce annual Total Energy Use Btu per Square Foot by a minimum of 40% by fiscal year 2024-2025 from a baseline fiscal year 2002-2003. We will also continue to track and manage water consumption.

Utility Management Plan Mandate- Measures

Our tracking measures will be the following State Key Performance Indicators (KPI):

- *Total Energy Use Btu per Square Foot*
- *Total Utilities Cost per Square Foot*
- *Total Energy Cost per Square Foot*

I have read and will support the Utility Management Plan for my Organization.

Implemented this 16 day of December, 2020

DocuSigned by:
John A. Nicholson
E784124F10E344F...
Chief Deputy Secretary

DocuSigned by:
Kimberly L. Van Metre
28637E8036744BF...
Chief Financial Officer

DocuSigned by:
Eric Turon
0FF56BADAAA04B9...
Facilities Engineering Manager

Submitted by:

Julie Pfeiffer
Utility Savings Initiative

Appendix of Tables for NCDEQ Utility Management Plan

FY 2020 – FY 2021 Executive Order No. 80 Update

Appendix Table 1: DEQ Buildings Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 5.22	$ 17.56		297,243	
2011-12	$ 4.55	$ 16.69	-5%	272,705	-8%
2012-13	$ 3.98	$ 18.11	3%	219,721	-26%
2013-14	$ 4.32	$ 20.30	16%	213,004	-28%
2014-15	$ 4.15	$ 19.89	13%	208,387	-30%
2015-16	$ 3.41	$ 16.33	-7%	208,946	-30%
2016-17	$ 3.18	$ 18.88	8%	168,362	-43%
2017-18	$ 2.50	$ 16.47	-6%	151,839	-49%
2018-19	$ 3.41	$ 18.07	3%	188,464	-37%
2019-20	$ 3.84	$ 19.09	9%	201,261	-32%

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year which puts the total energy reduction for DEQ at 32% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline.

Appendix Table 2: DEQ Buildings Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $	Propane gals	Propane $
10-11	$550,833	31,367	4,968,293	$ 428,428	142,512	$118,893	1792	$ 3,512
11-12	$480,275	28,778	4,305,027	$ 372,292	140,885	$107,974	5	$ 8
12-13	$419,839	23,187	4,660,789	$ 363,472	72,022	$ 54,739	891	$ 1,628
13-14	$456,367	22,478	4,149,933	$ 384,948	82,629	$ 69,258	603	$ 2,161
14-15	$437,491	21,991	3,945,660	$ 370,135	84,412	$ 64,109	947	$ 3,247
15-16	$359,980	22,049	3,402,930	$ 302,288	104,136	$ 56,711	273	$ 981
16-17	$335,429	17,767	3,184,744	$ 277,124	68,325	$ 55,860	741	$ 2,445

17-18	$303,618	18,433	3,040,599	$ 236,851	80,339	$ 65,822	265	$ 945
18-19	$338,345	18,721	3,418,012	$ 280,824	70,161	$ 56,109	466	$ 1,411
19-20	$381,711	19,992	3,224,230	$ 283,710	89,659	$ 97,180	276	$ 822

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year with most of that increase occurring in the cost of Natural gas. Actual therms used only rose slightly, but the cost almost doubled.

Appendix Table 3: DEQ Buildings Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 572,246	$ 550,833	$ 21,413	$ 5.42	$ 5.22	$ 0.20	105527
2011-12	$ 502,132	$ 480,275	$ 21,857	$ 4.76	$ 4.55	$ 0.21	105527
2012-13	$ 444,867	$ 419,839	$ 25,029	$ 4.22	$ 3.98	$ 0.24	105527
2013-14	$ 485,174	$ 456,367	$ 28,808	$ 4.60	$ 4.32	$ 0.27	105527
2014-15	$ 470,151	$ 437,491	$ 32,660	$ 4.46	$ 4.15	$ 0.31	105527
2015-16	$ 393,311	$ 359,980	$ 33,331	$ 3.73	$ 3.41	$ 0.32	105527
2016-17	$ 373,231	$ 335,429	$ 37,802	$ 3.54	$ 3.18	$ 0.36	105527
2017-18	$ 341,919	$ 303,618	$ 38,301	$ 2.82	$ 2.50	$ 0.32	121,397
2018-19	$ 378,914	$ 338,345	$ 40,569	$ 3.81	$ 3.41	$ 0.41	99,335
2019-20	$ 424,607	$ 381,711	$ 42,896	$ 4.27	$ 3.84	$ 0.43	99,335

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Energy costs have risen slightly during the last fiscal year, but this shows the increase was not due to significant increases in water/sewer.

Appendix Table 4: DEQ Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 21,413.00	1,507	$ 14.21		14.28		$ 0.20	105,527
2011-12	$ 21,857.00	1,442	$ 15.16	7%	13.66	-4%	$ 0.21	105,527
2012-13	$ 25,029.00	2,417	$ 10.36	-27%	22.90	60%	$ 0.24	105,527

2013-14	$ 28,808.00	3,114	$ 9.25	-35%	29.51	107%	$ 0.27	105,527
2014-15	$ 32,600.00	2,597	$ 12.58	-11%	24.61	72%	$ 0.31	105,527
2015-16	$ 33,331.00	2,450	$ 13.60	-4%	23.22	63%	$ 0.32	105,527
2016-17	$ 37,802.00	2,482	$ 15.23	7%	23.52	65%	$ 0.36	105,527
2017-18	$ 38,301.00	2,652	$ 14.44	2%	21.85	53%	$ 0.32	121,397
2018-19	$ 40,569.37	2,915	$ 13.92	-2%	29.34	105%	$ 0.41	99,335
2019-20	$ 42,895.84	2,547	$ 16.84	18%	25.65	80%	$ 0.43	99,335

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Water and sewer costs have risen slightly during the last fiscal year, but usage has decreased. Water and sewer costs have risen significantly.

Appendix Table 5: DEQ Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Propane $/gal	Electric $/therm	Nat Gas $/therm	Propane $/therm
2010-11	$ 0.086	$ 0.834	$ 1.96	$ 2.53	$ 0.83	$ 2.13
2011-12	$ 0.086	$ 0.766	$ 1.67	$ 2.53	$ 0.77	$ 1.81
2012-13	$ 0.078	$ 0.760	$ 1.83	$ 2.29	$ 0.76	$ 1.99
2013-14	$ 0.093	$ 0.838	$ 3.58	$ 2.72	$ 0.84	$ 3.90
2014-15	$ 0.094	$ 0.759	$ 3.43	$ 2.75	$ 0.76	$ 3.73
2015-16	$ 0.089	$ 0.545	$ 3.59	$ 2.60	$ 0.54	$ 3.91
2016-17	$ 0.087	$ 0.818	$ 3.30	$ 2.55	$ 0.82	$ 3.59
2017-18	$ 0.078	$ 0.819	$ 3.57	$ 2.28	$ 0.82	$ 3.87
2018-19	$ 0.082	$ 0.800	$ 3.03	$ 2.41	$ 0.80	$ 3.29
2019-20	$ 0.088	$ 1.084	$ 2.98	$ 2.58	$ 1.08	$ 3.24

This table shows data for DEQ combined sites which includes Reedy Creek and DMF. Costs for electricity and natural gas have increased while propane cost has decreased slightly.

Appendix Table 6: Reedy Creek Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 6.49	$ 16.68		389,121	
2011-12	$ 5.25	$ 16.22	-3%	323,448	-17%
2012-13	$ 4.55	$ 18.11	9%	251,077	-35%
2013-14	$ 4.98	$ 21.45	29%	232,010	-40%
2014-15	$ 4.88	$ 21.53	29%	226,808	-42%
2015-16	$ 3.99	$ 19.51	17%	204,561	-47%
2016-17	$ 3.45	$ 20.89	25%	165,205	-58%
2017-18	$ 2.23	$ 16.40	-2%	135,864	-65%
2018-19	$ 3.48	$ 17.10	2%	203,256	-48%
2019-20	$ 4.40	$ 17.62	6%	249,704	-36%

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year which puts the total energy reduction for Reedy Creek at 36% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline.

Appendix Table 7: Reedy Creek Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $
10-11	$392,738	23,540	3,489,360	$ 297,218	115,097	$ 92,821
11-12	$317,336	19,567	2,798,368	$ 248,462	100,193	$ 68,874
12-13	$275,076	15,189	3,319,440	$ 248,771	38,632	$ 26,305
13-14	$301,077	14,036	2,794,363	$ 266,575	45,013	$ 34,502
14-15	$295,430	13,721	2,726,751	$ 262,718	44,173	$ 32,712
15-16	$241,420	12,375	2,327,250	$ 212,295	44,345	$ 29,126
16-17	$208,790	9,994	2,081,784	$ 186,380	28,912	$ 22,410
17-18	$170,121	10,375	1,909,259	$ 144,950	38,610	$ 25,171
18-19	$188,736	11,038	2,040,338	$ 161,018	40,760	$ 27,719
19-20	$238,864	13,560	2,107,834	$ 162,015	63,680	$ 76,848

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year with most of that increase occurring in the cost of Natural gas. Actual therms used has increased by about 50%, but the cost almost tripled. Most of the increased usage can be attributed to the significant amount of equipment that was restored to working order over the past couple of years.

Appendix Table 8: Reedy Creek Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 404,801	$ 392,738	$ 12,063	$ 3.84	$ 3.72	$ 0.11	105527
2011-12	$ 332,094	$ 317,336	$ 14,757	$ 3.15	$ 3.01	$ 0.14	105527
2012-13	$ 292,121	$ 275,076	$ 17,045	$ 2.77	$ 2.61	$ 0.16	105527
2013-14	$ 323,020	$ 301,077	$ 21,943	$ 3.06	$ 2.85	$ 0.21	105527
2014-15	$ 318,127	$ 295,430	$ 22,698	$ 3.01	$ 2.80	$ 0.22	105527
2015-16	$ 264,120	$ 241,420	$ 22,700	$ 2.50	$ 2.29	$ 0.22	105527
2016-17	$ 236,511	$ 208,790	$ 27,721	$ 2.24	$ 1.98	$ 0.26	105527
2017-18	$ 197,546	$ 170,121	$ 27,425	$ 1.63	$ 1.40	$ 0.23	121,397
2018-19	$ 219,331	$ 188,736	$ 30,595	$ 2.21	$ 1.90	$ 0.31	99,335
2019-20	$ 269,074	$ 238,864	$ 30,211	$ 2.71	$ 2.40	$ 0.30	99,335

This table shows data for Reedy Creek alone. Energy costs have risen slightly during the last fiscal year, but this shows the increase was not due to significant increases in water/sewer.

Appendix Table 9: Reedy Creek Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 12,063.47	966	$ 12.49		15.97		$ 0.11	105,527
2011-12	$ 14,757.38	792	$ 18.63	49%	13.09	-18%	$ 0.14	105,527
2012-13	$ 17,044.63	1,797	$ 9.49	-24%	29.70	86%	$ 0.16	105,527
2013-14	$ 21,943.31	2,617	$ 8.38	-33%	43.26	171%	$ 0.21	105,527
2014-15	$ 22,697.54	1,930	$ 11.76	-6%	31.90	100%	$ 0.22	105,527
2015-16	$ 22,699.65	1,826	$ 12.43	0%	30.18	89%	$ 0.22	105,527
2016-17	$ 27,720.90	1,902	$ 14.57	17%	31.44	97%	$ 0.26	105,527

2017-18	$ 27,425.15	2,059	$ 13.32	7%	26.96	69%	$ 0.23	121,397
2018-19	$ 30,594.76	2,300	$ 13.30	7%	42.35	165%	$ 0.31	99,335
2019-20	$ 30,210.80	2,233	$ 13.53	8%	41.11	157%	$ 0.30	99,335

This table shows data for Reedy Creek alone. Water and sewer costs have remained relatively stable during the last fiscal year.

Appendix Table 10: Reedy Creek Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Electric $/therm	Nat Gas $/therm
2010-11	$ 0.085	$ 0.806	$ 2.50	$ 0.81
2011-12	$ 0.089	$ 0.687	$ 2.60	$ 0.69
2012-13	$ 0.075	$ 0.681	$ 2.20	$ 0.68
2013-14	$ 0.095	$ 0.766	$ 2.80	$ 0.77
2014-15	$ 0.096	$ 0.741	$ 2.82	$ 0.74
2015-16	$ 0.091	$ 0.657	$ 2.67	$ 0.66
2016-17	$ 0.090	$ 0.775	$ 2.62	$ 0.78
2017-18	$ 0.076	$ 0.652	$ 2.23	$ 0.65
2018-19	$ 0.079	$ 0.680	$ 2.31	$ 0.68
2019-20	$ 0.077	$ 1.207	$ 2.25	$ 1.21

This table shows data for Reedy Creek alone. The cost for natural gas has almost doubled while electricity has decreased very slightly.

Appendix Table 11: DMF Energy Performance All Fuels by Fiscal Year

Fiscal year	Energy Cost per GSF $/gsf	Cost per million Btu of Energy $/mmbtu	% Change Cost per million Btu of Energy	Energy per GSF Btu/gsf	% Change Energy per GSF
2010-11	$ 3.51	$ 20.20		173,824	
2011-12	$ 3.62	$ 17.69	-12%	204,534	18%
2012-13	$ 3.21	$ 18.10	-10%	177,603	2%
2013-14	$ 3.45	$ 18.39	-9%	187,476	8%
2014-15	$ 3.15	$ 17.18	-15%	183,647	6%

2015-16	$ 2.63	$ 12.26	-39%	214,838	24%
2016-17	$ 2.81	$ 16.29	-19%	172,608	-1%
2017-18	$ 2.96	$ 16.57	-18%	178,931	3%
2018-19	$ 3.32	$ 19.47	-4%	170,629	-2%
2019-20	$ 3.17	$ 22.21	10%	142,843	-18%

This table shows data for DMF alone. Energy used per gross square foot has decreased slightly during the last fiscal year which puts the total energy reduction for DMF at 18% less than their 2010-11 baseline. The EO80 goal is a 40% energy reduction from the baseline. DMF still has significant work to do before achieving a 40% energy reduction goal.

Appendix Table 12: DMF Energy Cost & Usage by Fuel Type

Fiscal year	Total Energy $	Total energy million Btu	Electric kwh	Electric $	Natural Gas therms	Natural Gas $	Propane gals	Propane $
10-11	$158,095	7,827	1,478,933	$ 131,211	27,415	$ 26,072	433	$ 812
11-12	$162,939	9,210	1,506,659	$ 123,830	40,692	$ 39,101	5	$ 8
12-13	$144,762	7,998	1,341,349	$ 114,700	33,390	$ 28,434	891	$ 1,628
13-14	$155,290	8,442	1,355,570	$ 118,373	37,616	$ 34,756	603	$ 2,161
14-15	$142,061	8,270	1,218,909	$ 107,417	40,238	$ 31,397	947	$ 3,247
15-16	$118,560	9,674	1,075,680	$ 89,993	59,791	$ 27,586	273	$ 981
16-17	$126,639	7,773	1,102,960	$ 90,744	39,413	$ 33,450	741	$ 2,445
17-18	$133,498	8,057	1,131,340	$ 91,900	41,729	$ 40,652	265	$ 945
18-19	$149,608	7,684	1,377,674	$ 119,806	29,401	$ 28,391	466	$ 1,411
19-20	$142,847	6,432	1,116,396	$ 121,694	25,979	$ 20,332	276	$ 822

This table shows data for DMF alone. Energy costs except for electricity have decreased slightly during the last fiscal year.

Appendix Table 13: DMF Energy & Water Cost and Indexed by GSF

Fiscal year	Total Utility $	Total Energy $	Water-Sewer $	Total Utility $/GSF	Energy $/GSF	Water $/GSF	GSF
2010-11	$ 167,445	$ 158,095	$ 9,350	$ 1.59	$ 1.50	$ 0.09	105527
2011-12	$ 170,038	$ 162,939	$ 7,100	$ 1.61	$ 1.54	$ 0.07	105527
2012-13	$ 152,746	$ 144,762	$ 7,984	$ 1.45	$ 1.37	$ 0.08	105527
2013-14	$ 162,155	$ 155,290	$ 6,865	$ 1.54	$ 1.47	$ 0.07	105527
2014-15	$ 152,024	$ 142,061	$ 9,962	$ 1.44	$ 1.35	$ 0.09	105527
2015-16	$ 129,191	$ 118,560	$ 10,631	$ 1.22	$ 1.12	$ 0.10	105527
2016-17	$ 136,720	$ 126,639	$ 10,081	$ 1.30	$ 1.20	$ 0.10	105527
2017-18	$ 144,373	$ 133,498	$ 10,876	$ 1.19	$ 1.10	$ 0.09	121,397
2018-19	$ 159,583	$ 149,608	$ 9,975	$ 1.61	$ 1.51	$ 0.10	99,335
2019-20	$ 155,532	$ 142,847	$ 12,685	$ 1.57	$ 1.44	$ 0.13	99,335

This table shows data for DMF alone. Energy costs have decreased slightly during the last fiscal year, but water and sewer costs have increased a small amount.

Appendix Table 14: DMF Water Data Cost and Usage

Fiscal year	Water & Sewer Cost $	Total Usage in 1,000 gal (kgal)	Cost per 1,000 gal $/kgal	% Change $/kgal	gal/sf	% Change gal/sf	Water-sewer $/gsf	gsf
2010-11	$ 9,350	541	$ 17.28		12.01		$ 0.09	105,527
2011-12	$ 7,100	650	$ 10.93	-37%	14.42	20%	$ 0.07	105,527
2012-13	$ 7,984	619	$ 12.89	-25%	13.76	15%	$ 0.08	105,527
2013-14	$ 6,865	497	$ 13.82	-20%	11.03	-8%	$ 0.07	105,527
2014-15	$ 9,962	667	$ 14.93	-14%	14.82	23%	$ 0.09	105,527
2015-16	$ 10,631	624	$ 17.04	-1%	13.85	15%	$ 0.10	105,527
2016-17	$ 10,081	580	$ 17.38	1%	12.88	7%	$ 0.10	105,527
2017-18	$ 10,876	593	$ 18.33	6%	13.18	10%	$ 0.09	121,397
2018-19	$ 9,975	615	$ 16.21	-6%	13.66	14%	$ 0.10	99,335
2019-20	$ 12,685	315	$ 40.30	133%	6.99	-42%	$ 0.13	99,335

This table shows data for DMF alone. Water and sewer costs have risen sharply during the last fiscal year, but usage has almost halved. The drastic change in this data could possibly be traced to a reporting error.

Appendix Table 15: DMF Fuel Cost Comparison

Fiscal year	$/kwh	$/therm	Propane $/gal	Electric $/therm	Nat Gas $/therm	Propane $/therm
2010-11	$ 0.089	$ 0.951	$ 1.87	$ 2.60	$ 0.95	$ 2.04
2011-12	$ 0.082	$ 0.961	$ 1.60	$ 2.41	$ 0.96	$ 1.74
2012-13	$ 0.086	$ 0.852	$ 1.83	$ 2.51	$ 0.85	$ 1.99
2013-14	$ 0.087	$ 0.924	$ 3.59	$ 2.56	$ 0.92	$ 3.90
2014-15	$ 0.088	$ 0.780	$ 3.43	$ 2.58	$ 0.78	$ 3.73
2015-16	$ 0.084	$ 0.461	$ 3.60	$ 2.45	$ 0.46	$ 3.91
2016-17	$ 0.082	$ 0.849	$ 3.30	$ 2.41	$ 0.85	$ 3.59
2017-18	$ 0.081	$ 0.974	$ 3.56	$ 2.38	$ 0.97	$ 3.87
2018-19	$ 0.087	$ 0.966	$ 3.03	$ 2.55	$ 0.97	$ 3.29
2019-20	$ 0.109	$ 0.783	$ 2.98	$ 3.19	$ 0.78	$ 3.24

This table shows data for DMF alone. Costs for electricity has increased while natural gas and propane costs have decreased slightly.

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Intermediary Delivery Events	Status	Timestamp

Certified Delivery Events	Status	Timestamp

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Witness Events	Signature	Timestamp

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Browsers (for SENDERS):	Internet Explorer 6.0? or above
Browsers (for SIGNERS):	Internet Explorer 6.0?, Mozilla FireFox 1.0, NetScape 7.2 (or above)
Email:	Access to a valid email account
Screen Resolution:	800 x 600 minimum
Enabled Security Settings:	•Allow per session cookies •Users accessing the internet behind a Proxy Server must enable HTTP 1.1 settings via proxy connection

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Strategic Energy and Water Plan

North Carolina Department of Health and Human Services

August 31, 2021

Prepared By:

Division of Property & Construction

3026 Mail Service Center

Raleigh, NC 27699-3026

Executive Summary

The North Carolina Department of Health and Human Services (DHHS) has approximately 635 State owned buildings at 14 different institutions across the state encompassing roughly 7.6 million square feet of space. These institutions include psychiatric hospitals, neuro-medical treatment centers, alcohol and drug abuse treatment centers, developmental disability centers, and vocational rehabilitation centers.

DHHS is committed to improving building energy performance and water consumption at these institutions to reduce costs and the potential for any negative impact to the environment.

DHHS will reduce energy and water usage by identifying and implementing projects to improve the efficiency of utility systems. DHHS has utilized various funding sources including American Recovery and Reinvestment Act (ARRA) and repair and renovation funds to complete energy conservation projects.

General Items for the DHHS Strategic Energy and Water Plan include the following:

1. Consolidating building occupants in buildings with a high square foot per person so that buildings may be closed off and HVAC system temperatures set back or turned off completely.

2. Recommissioning existing HVAC control systems to optimize energy savings. Verification of proper outdoor air set points on HVAC systems.

3. Tuning up of existing boilers to provide optimal burner efficiency.

4. When HVAC equipment is due for replacement, replace this equipment with high efficiency replacements. When office equipment and appliances are due for replacement, replace with energy star rated equipment.

5. Survey each campus for energy savings opportunities. Identify system leaks and repair them.

6. Replace existing lighting (incandescent or fluorescent) with LED lighting.

7. Install lighting occupancy sensors in appropriate areas/rooms.

8. Implement temperature setbacks for non-occupied time periods for non-patient areas. Provide proper deadband between heating and cooling setpoints in all occupancies.

9. Prohibit personal space heaters and mini refrigerators.

10. Repair and caulk leaks in windows and doors. Add building insulation where needed or where it does not exist.

Current elements of the DHHS Strategic Energy and Water Plan include the following:

1. Identifying and implementing renovation projects when required due to the age and condition or change in use of buildings. The requirements of General Statute 143.135-25 which mandates minimum energy and water reduction for new construction and major renovation projects will ensure improved energy and water use performance.

These improvements generally include some or all the following: replacing windows; upgrading building insulation; and replacing HVAC, controls, lighting, and plumbing systems.

1. Lighting replacement with LED fixtures at multiple facilities.

2. At J. Iverson Riddle Developmental Center, replace the domestic water heater at the Mulberry Building.

3. At J. Iverson Riddle Developmental Center, replace aging domestic water and sewer piping.

4. At J. Iverson Riddle Developmental Center, replace the aging air-cooled chiller at Birch Cottage which serves three (3) residential buildings.

5. At John Umstead Campus, upgrade the HVAC system at Building 27A.

6. At Julian Keith ADATC, upgrade Dorms 1 & 2.

7. At Julian F. Keith ADATC, replace the aging condensing unit at the Activities/Gym Building.

8. At O'Berry NMTC, upgrade the HVAC system at the Administration Building.

9. At O'Berry NMTC, replace the windows at ELC-2.

10. Completing various selected smaller projects in buildings to address specific needs and to reduce energy and water usage including replacing existing inefficient HVAC equipment with modern and energy efficient equipment.

The Facility Maintenance Director serves as the Energy Manager at each institution and is responsible for identifying and ensuring that energy conservation projects are completed in a timely manner.

The Department has committed to hiring an Energy Manager whose responsibilities will include working with facility maintenance staff to identify and implement energy conservation projects, maximizing energy efficiency of HVAC systems including DDC systems, and monitoring results at each facility. The Department is looking at vacant positions to reclassify and other options to create, post, and fill the Energy Manager position.

The Department has contracted with Capturis, a utilities management consultant, to receive and document utility usage and corresponding costs at all DHHS State owned facilities. The Department is in the process of acquiring and providing information requested by Capturis for them to begin their services. The goal is to have Capturis receiving all utility invoices by November 1, 2021.

The main Key Performance Indicators (KPIs) consist of British thermal units per gross square foot (btu/gsf) for energy use and gallons/gsf for water use. Due to the expense of metering each building, utility invoices will be utilized to monitor and report overall energy and water usage for all State owned buildings on each DHHS campus statewide.

Organizational Support for Energy Culture Change

1. Educate staff through presentations, emails, handouts, subcommittees, and other effective forms of communication about energy and water conservation practices they can implement daily.

2. Incorporate energy and water conservation discussions and presentations as appropriate into institutional and departmental meetings.

3. Encourage staff to identify and attend energy and water conservation training.

4. Establish policy that requires evaluation of both costs and energy efficiency when selecting equipment to be purchased and that requires giving preference to Energy Star products when possible.

Organizational Culture Change Projects

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Continuation of existing activities							Facility Maintenance and Division of Property & Construction	GF

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Educate staff regarding NC energy legislation, State Energy Office policies and resources, and Strategic Energy Planning techniques.							Facility Maintenance and Division of Property & Construction	GF
Encourage staff to identify and attend energy and water conservation training.							Facility Maintenance and Division of Property & Construction	GF
Establish policy that requires evaluation of both costs and energy efficiency when selecting equipment to be purchased and that requires giving preference to Energy Star products when possible.							Facility Maintenance and Division of Property & Construction	GF

1. Supply Side

a. Review all accounts with utility providers to ensure lowest cost Rate Schedule is in effect for each facility.

b. Identify locations, meter ID, and account numbers for all existing primary meters installed by utility providers. Request utility providers to install new digital meters to replace any analog meters. Request new digital meters to be remote reading type compatible with existing Building Management System (BMS) software whenever possible.

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Continuation of existing activities							Facility Energy Manager and Division of Property & Construction	GF

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Contact Duke Progress and the local utility provider to review all electrical rates							Facility Energy Manager	GF
Contact Piedmont Natural Gas to review all gas rates							Facility Energy Manager	GF
Contact local water service providers to review water rates							Facility Energy Manager	GF

2. Demand Side

a. Building assessments will be completed at each DHHS institution to identify the condition of buildings including the age, type, and condition of the building equipment and lighting. These building assessments will serve as the basis for identifying building needs, developing scope of work for projects, developing estimated project costs, prioritizing project needs, and for requesting and obtaining funding to complete the projects and realize reductions in energy and water consumption.

b. Facility Maintenance staff at each institution will make the effort to identify potential energy and water conservation improvement opportunities by evaluating the existing HVAC control system including considering the following:

i. Time of day/night setback sequences.
ii. Chilled water and hot water set point optimization.
iii. Air handling unit (AHU) set point optimization.
iv. Outdoor air damper operation (closed when building is not occupied)
v. General verification of the operation of the building control system.
vi. Installation of variable speed drives.

Past 12 Months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Lighting replacement with LED fixtures – Multiple facilities.					$250,000		Division of Property & Construction	RR
Broughton Hospital – Domestic Water Heater Replacement					$174,000		Division of Property & Construction	RR
J. Iverson Riddle Developmental Center – Mulberry Building Domestic Water Heater Replacement					$74,000		Division of Property & Construction	RR
J. Iverson Riddle Developmental Center – Willow Cottage Replace Domestic Water & Sewer Piping					$210,000		Division of Property & Construction	RR
J. Iverson Riddle Developmental Center – Replace chiller serving					$116,000		Division of Property &	RR

Birch Building							Construction	
J. Iverson Riddle Developmental Center – Maple Roof Replacement					$149,000			
Murdoch Center – G5 Building Roof Replacement					$389,000		Division of Property & Construction	RR
Public Health Lab – Cooling Tower Replacement					$731,000		Division of Property & Construction	RR

Next 12 Months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Black Mountain NMTC – Bathroom Upgrades – Gravely 3 & Rasberry 3					$81,000		Division of Property & Construction	2020 R&R
Black Mountain NMTC – Renovations to Gravely Building					$6,587,000		Division of Property & Construction	2021 R&R
J. Iverson Riddle Developmental Center – Spruce Cottage Renovation					$5,164,000		Division of Property & Construction	2021 R&R
J. Iverson Riddle Developmental Center – Cedar Cottage Renovation					$10,313,000		Division of Property & Construction	2021 R&R
John Umstead Campus – Building 27A – HVAC Upgrades					$471,000		Division of Property & Construction	2020 R&R
Julian F. Keith ADATC – Dorms 1 & 2 Building Upgrades					$2,000,000		Division of Property &	2020

							Construction	R&R
Julian F. Keith ADATC – Activities/ Gym Building A/C Unit Replacement					$75,000		Division of Property & Construction	2020 R&R
Longleaf NMTC – Scott Wing HVAC & Plumbing Upgrades					$15,326,000		Division of Property & Construction	2021 R&R
Murdoch Center – Ridgeway Cottage Renovation					$8,501,000		Division of Property & Construction	2021 R&R
O'Berry NMTC – ELC-3 Building System Upgrades					$9,475,000		Division of Property & Construction	2021 R&R
O'Berry NMTC – Administration Building HVAC Upgrades					$355,000		Division of Property & Construction	2020 R&R
O'Berry NMTC – Window Replacement at ELC-2					$457,000		Division of Property & Construction	2020 R&R

Note: Based upon anticipated funding for 2021, additional projects will be added to this list.

The DHHS Utility Report showing energy and water usage and associated costs is included as a separate attachment. Note the following regarding the DHHS Utility Report:

1. The Special Care Center is Longleaf Neuro-Medical Treatment Center located at 4761 Ward Boulevard, Wilson, NC 27893.
2. The John Umstead Hospital data includes the R.J. Blackley Alcohol and Drug Abuse Treatment Center (ADATC) located at 1003 12th Street, Butner, NC 27509.
3. The Central Regional Hospital data includes the John Umstead Hospital (and R.J. Blackley ADATC) data starting in 2010-11.
4. The Dorothea Dix Hospital includes the Governor Morehead School starting in 2007-08.

5. The Vocational Rehabilitation combines both Work Source East located at 902 Corporate Drive, Goldsboro, NC 27534 and Work Source West located at 200 Enola Road, Morganton, NC 28655.

Confirmation:

This Strategic Energy and Water Plan is approved for the NC Department of Health and Human Services by its authorized representative, Luke O. Hoff, PE, Director of the Division of Property and Construction.

DocuSigned by:

Approved: Luke Hoff Date: 8-31-2021

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North Carolina Department of Information Technology (DIT)

Strategic Energy Management Plan

Measure, Track, and Reduce Energy and Water Consumption at Data Centers (EDC/WDC)

NCDIT-DSC-IOEDC / WDC – 0070

Version 0.1

July 2, 2020

Prepared for

NC Department of Information Technology

P.O. Box 17209, Raleigh, NC 27619-7209

Prepared by

Department of Information Technology Infrastructure Operations

Western Data Center

P.O. Box 17209, Raleigh, NC 27619-7209

Executive Summary

The DIT Eastern Data Center facility located at 3700 Wake Forest Rd, in Raleigh, NC, is nearly 40 years old and has housed the State's primary data center for about 29 years. The DIT Western Data Center is 13 years old and has taken on an increasing server load as it has transitioned away from being primarily backup and recovery. It is now a big part of agency consolidation efforts.

Both locations are open 24 hours per day, 365 days per year. At the EDC there typically are about 400 employees working from 8 am till 6 pm Monday through Friday, 30 employees on second shift Monday through Friday, and 20 employees third shift Monday through Friday. Approximately 10 employees are on site for 24 hours per day on the weekends and holidays. At the WDC there are about 34 total employees counting security and janitorial. There are typically about 12-13 employees onsite between 8am and 5pm with the rest covering the other shifts and weekends.

The nature of DIT's Data center facilities differs from most State buildings in that the energy consumption is constantly variable depending on the number of Servers, Network, and other types of Information Technology equipment currently in use. DIT offers numerous IT services supported by the Data centers to the other State Agencies. Much of the IT equipment which is used by these services are in the Data centers. Floor hosted options are also offered to the agencies where they utilize a spot on the Data floor with a DIT supplied rack, power, and cooling. Customers can also supply their own racks/cabinets if desired. The agencies need's change over time and is generally an upward trend from a power consumption view.

Energy Consumption based on square footage does not give an accurate representation of the efficiency of a Data center. The industry standard for Data center efficiency is Power Usage Effectiveness (PUE). That is the ratio between the Total building load and the IT load. The best way to increase PUE is to maximize the amount of IT equipment served and lower the energy consumption of the HVAC and lighting systems. Maximizing the PUE is very much dependent on the other State agencies participation in using more DIT services and/or bringing in more hosted equipment. That said, more equipment being brought in increases our energy consumption per square foot. We could become vastly more efficient and yet be no closer to reaching the 40% energy reduction per sq foot.

To get to a point where energy per sq foot is somewhat useful both the Eastern and Western Data Centers would need to be full. This would have to happen to even get a viable baseline. Again, since we are serving other State agencies, DIT has limited ability to fully utilize all the power and floor space available. An example would be an agency that pays for seven racks and only uses four of them with the others held for future growth. On a floor space basis, the Data center utilization is about 50%.

Energy and Water Data Management: WDC Facilities began using spreadsheets to monitor water and diesel fuel in 2009 and Electricity in 2015. Annual data for cost and usage for electricity, fuels and water have been reported to the NC Energy Office since 2007-08 when the WDC was first built. The EDC has been reporting to the energy office since it was required. There will be a renewed focus on monitoring energy consumption going forward. From the meter all the way down to equipment level at both data centers. This will allow us to find the areas we need to concentrate on. We hope to get a combined PUE chart for both data centers in the coming year.

Energy and Water Supply Management: Electric, Water and Fuel bills are reviewed monthly and abnormal usage is investigated. The Facility Manager's meet with Duke Energy representative's at least once a year to review rates and anything that may affect each Data Center.

Equipment and Building Efficiency: Regular documented equipment maintenance enables the equipment to run as efficiently as possible. Walls and windows are resealed as needed.

Existing Conditions: The EDC is a 94,343 with about 15,000 sq ft. of data floor with the rest being office space, warehouse, and shipping. Two Carrier Air Handlers. We have three Trane Chillers (each at 500 tons), 1 Rheem Round 120 Gallon Tank and Rheem Round 50 Gallon Tank for the building HOT water.

Novar Controls-for all HVAC points. Three 2500kw Caterpillar generators.

The WDC is a 53,000 sq ft. Data Center with two 500-ton and one 50-ton Trane Chillers, three 2500kw Caterpillar generators, and three 750kw Emerson UPS. The building is designed to support the IT operations of the 15,000 sq ft. data floor, office space, small warehouse and receiving.

The Department of Information Technology will strive to meet the goals set forth in EO 80. We will work toward conservation of energy and water resources at all our locations by creating, implementing, and following an effective Energy and Water Management Plan. The objective of the Plan is to guide the fiscally and environmentally responsible usage of valuable resources in accordance with state legislation, while striving to ensure a safe environment that provides an acceptable level of comfort for staff, and visitors.

FY 2019/20 Usage

Factors

Several unusual factors came into play in 2020. The Covid-19 Pandemic has greatly reduced onsite work at the EDC with hundred employees working from home. IT personnel at the WDC are also working predominantly from home, however at the WDC this is offset by multiple vendor personnel being onsite with the fiber project.

The WDC Fiber project required 3-4 weeks of intense under the floor work in the Data room. During this time, large number of tiles were removed to perform the work. Our fan gallery fans were running at full capacity 8-9 hours a day during this time. A 40-50% increase over normal.

The WDC Building Management System was upgraded over three phases starting in February. During this time, the main controller and software, AHU 1-2 controllers and the Chiller Plant controllers were replaced. Over the course of the upgrade, both 500-ton chillers were run at the same time multiple times for several hours for testing. Other Air handlers and equipment were run more than usual as well. Spring is the time of year we would typically see a reduction in power consumption.

Due to these factors the WDC saw a very slight increase in electrical consumption this year. The EDC saw a decrease in electrical consumption at least partially due to the pandemic. Both data centers saw a large decrease in Diesel fuel consumption. Primarily due to better weather conditions over the previous year and reduced run times at the WDC. We also went to a once a month schedule for several months due to the pandemic. Winter weather and Hurricanes can greatly increase the amount of run time needed.

BTU's per square foot were down significantly this year. 318,196 vs 360,839.

Metric	Baseline 2002-03	Current 2019-20	% Change
Gross Square feet	94,343	163866	74%
Utility cost	$362,255	$1,204,029	232%
Btu per square foot per year	272,914	318,196	17%
Cost per million Btu	$13.67	$20.62	51%
Water gallons per square foot	90	72.51	-19%
Water cost per thousand gal	$1.23	$10.64	765%

2019/20 updates

- We are now running three mechanical cooling units in the UPS room at the WDC rather than four. Cooling is still maintained within recommended temperature and humidity for the UPS.
- The Bi-weekly generator test runtime was reduced by 20 minutes at the WDC and has contributed to lower fuel consumption this year.
- Water heater for eyewash station shut off. Not needed to maintain water within OSHA specifications.
- 1000 LED plug and play Philips bulbs were purchased for installation in the Data room during the 20-21 year. Installation is underway.
- All the lighting at the EDC was replaced with LED and completed during the 19-20 year.
- Computer room air conditioners were replaced at the EDC during the 19-20 year with new more efficient units.

- Lag Chiller setting at the WDC was reduced from 1 hour to 30 minutes. Lag chiller typically runs 3-4 times per year during testing and sometimes due to power outages. The reduction is the amount of time it will run after temps are normal.
- During the WDC BMS upgrades it was found that we can run the AHU chilled water loop at a higher pressure and lower gallons per minute with greater cooling efficiency.

Goals for 2020-21

Focus Areas

78% of the WDC's building load is the Chillers and UPS server and network load. The remaining 22% is Pumps, Air Handling, heating, and lighting load. 50% of the load is the servers and networks. Managing the servers and networks with efficiency in mind must be a priority. When new equipment is purchased, high efficiency must be part of the purchase criteria. Agency hosting customers must be part of the process as well.

We need a renewed focus and buy in from upper management and HR to reduce energy usage by adopting a personal appliance use policy. Space heaters in particular are inefficient and can be a fire hazard. Reduction in energy usage by implementing computer power management for all ITS personal computers (where applicable). Purchasing energy efficient computer equipment, Servers, storage units, tape drives, where applicable. We need continued analysis of both Data Centers to potentially lower energy usage by increased efficiencies.

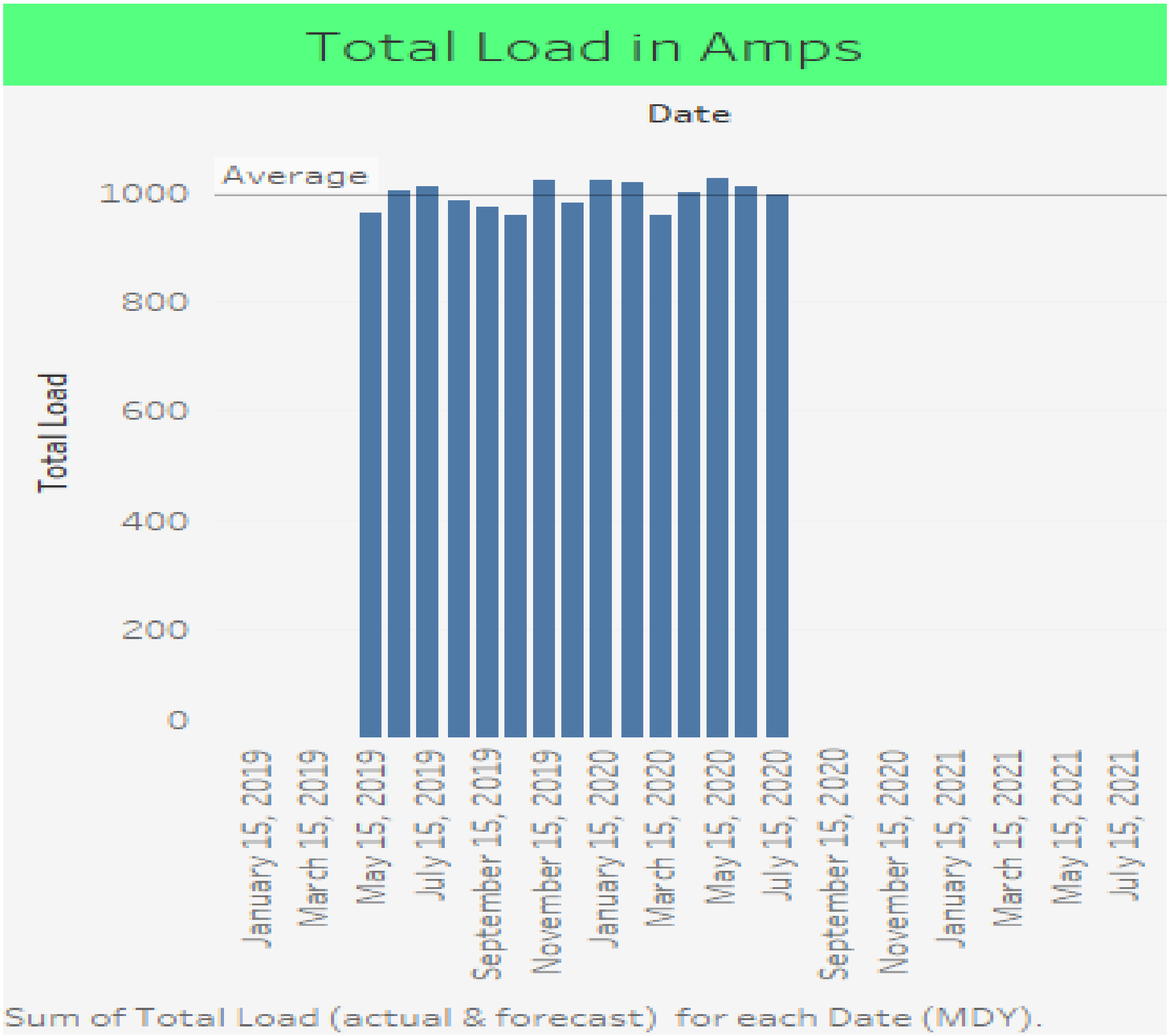
- Continue with energy efficiency training opportunities.
- EDC to have the electrical distribution project engineering study done this year. Though it is not specifically an energy reduction project, when the project is completed, we expect greater electrical monitoring capabilities, higher efficiency equipment and reliability.
- Complete the Data room LED installation at the WDC.
- Continue installing LED's in the rest of the WDC as the fluorescents fail.

- Start monitoring the PUE of the EDC like is being done at the WDC. With the current setup at the EDC it will be cumbersome to start, but after the electrical upgrades are done it should be much easier.
- Create a combined Data center PUE chart.
- Sixteen new server cabinets installed in June 2020, were equipped with smart power bars that will allow control and monitoring down to the outlet level. Upgrades in the future for all the existing cabinets is in the planning stages. (funding dependent)
- Continue monitoring both water and electrical metering to ensure it is correct and meet with Duke energy representative twice per year to stay abreast of anything that may affect our rates or service.
- Investigate water consumption at the EDC. It is still substantially higher than the EDC even with most of the IT staff working from home.

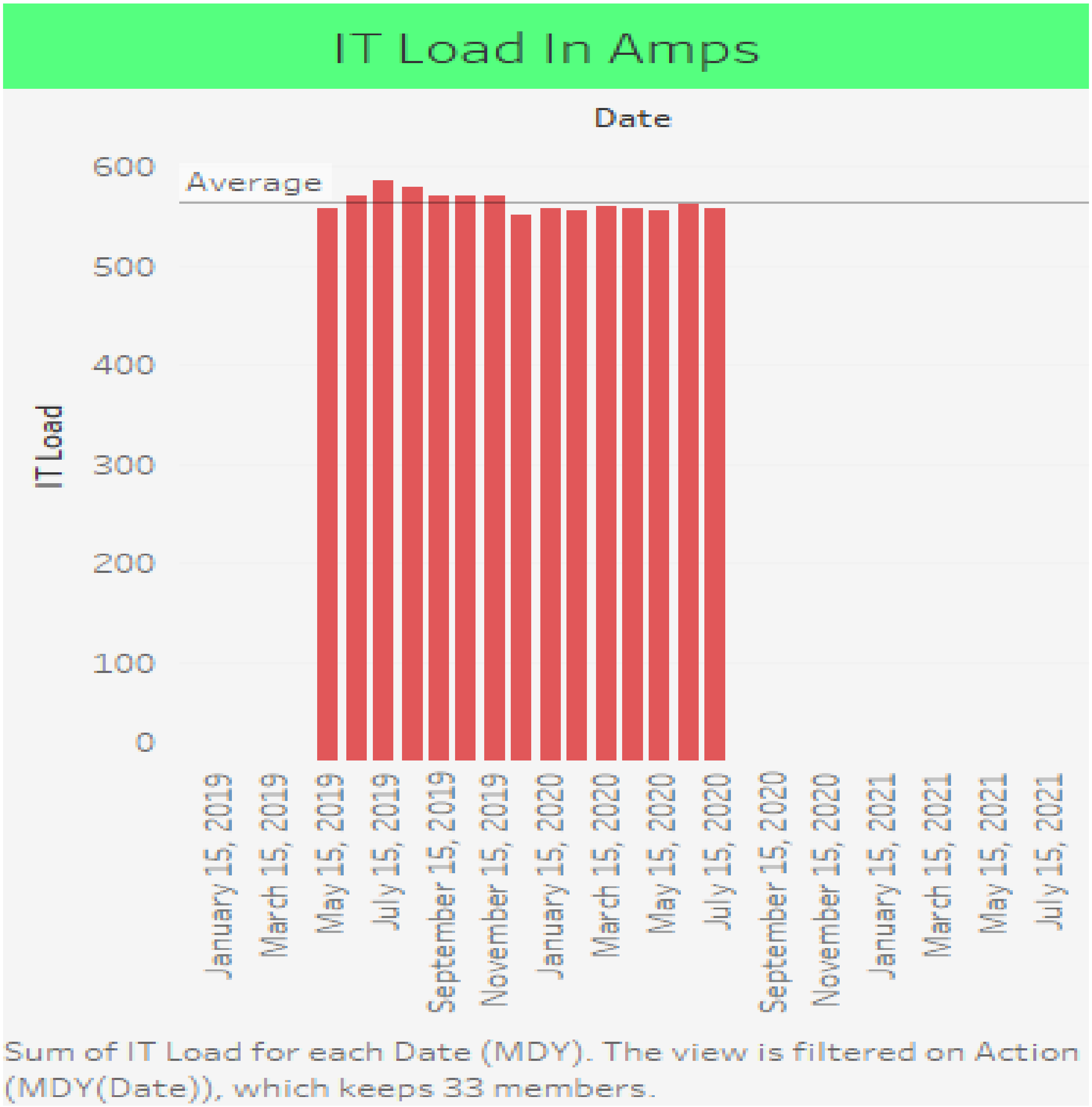
Future projects

- Work on potential funding for a more efficient third chiller at the WDC.
- Scheduled replacement of the existing UPS units at the WDC with more efficient units. 85% vs 93-97%. Two to three years out.
- EDC to complete the electrical distribution project. Funded.
- Enclosed cold aisles at the WDC. Not funded. Need to work up potential savings.

Graphical Representation of the WDC Electrical loads

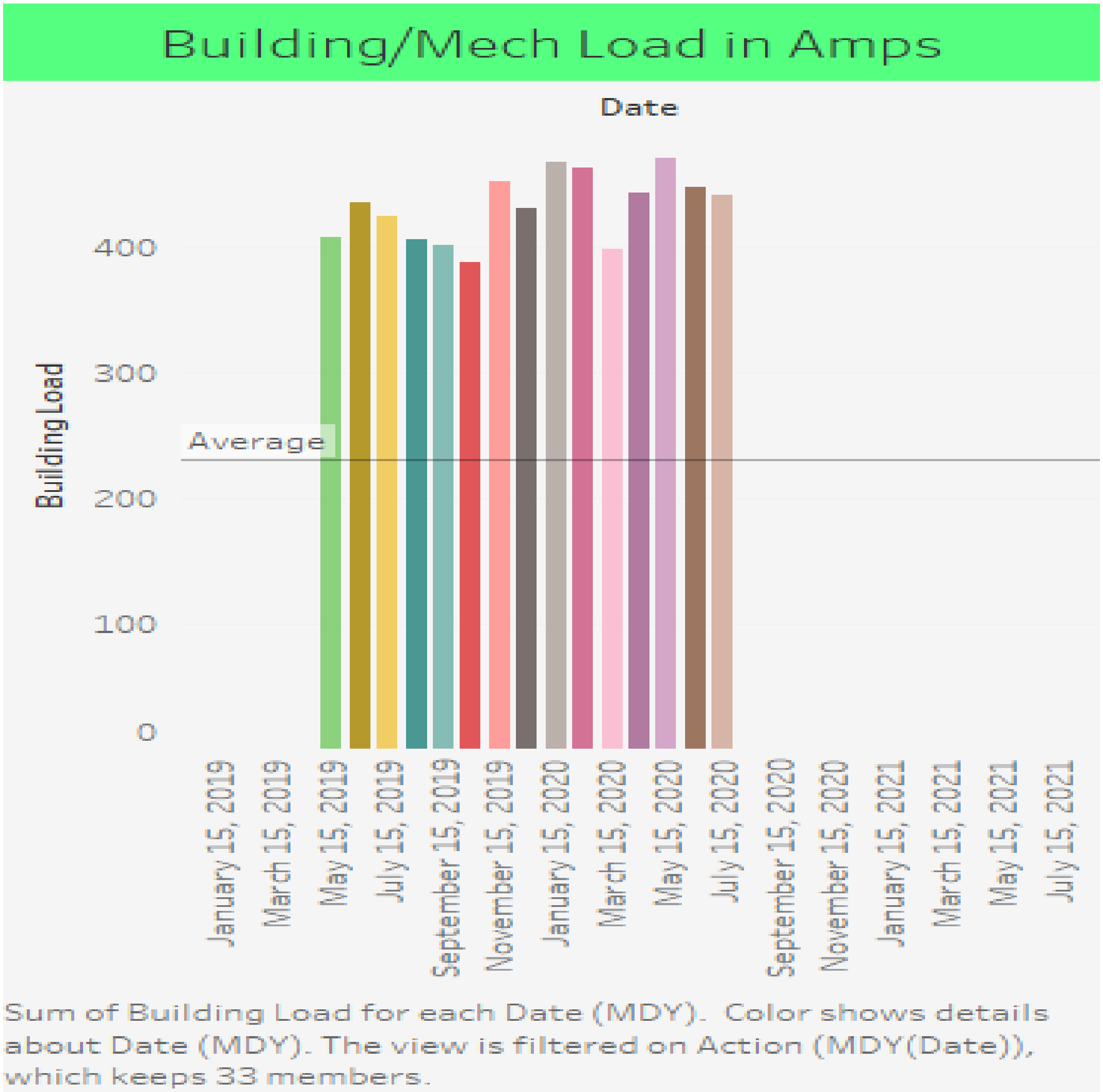


This May and June year over year were likely higher due to the fiber and building management system projects and upgrades.

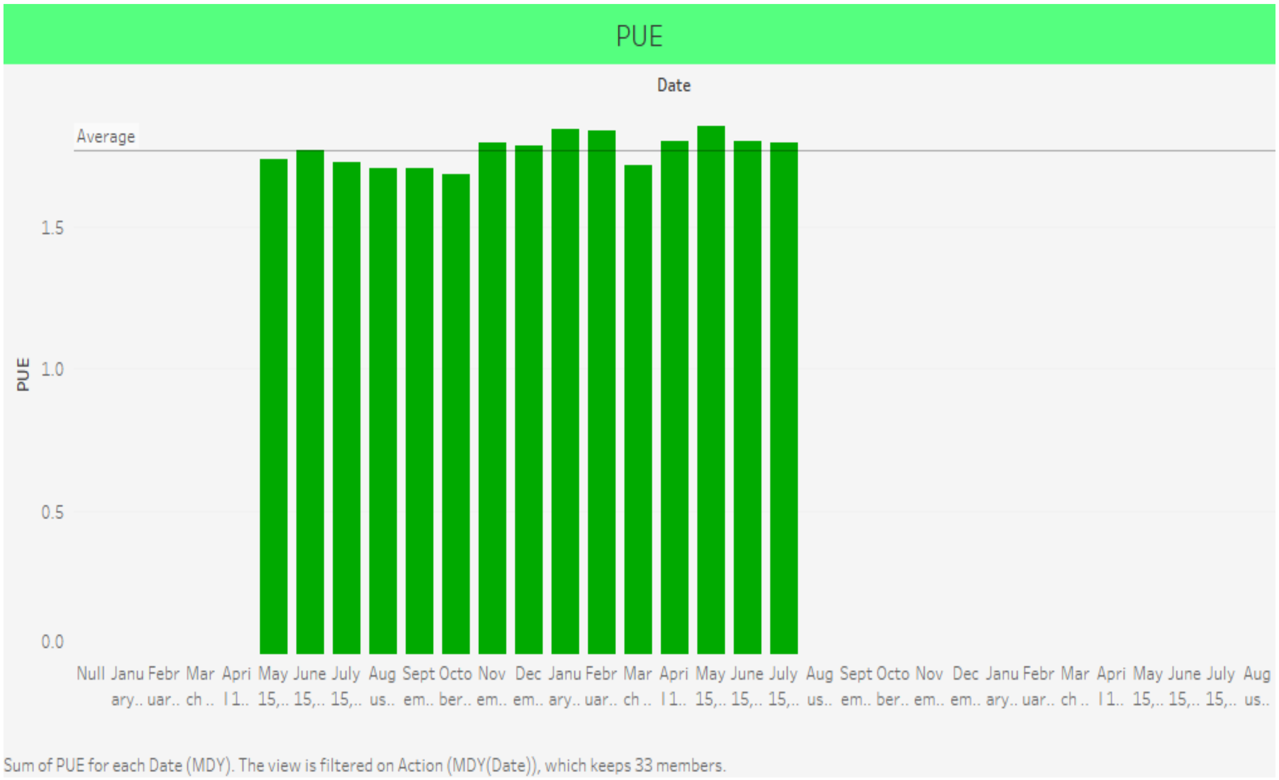


IT load has trended downward due to changes in the amount of equipment in the Data room.

Refreshes and virtualization account for the trend.



Mechanical Cooling loads trended up during the spring and summer due to the Fiber and BMS projects.



Power usage effectiveness (PUE) is the industry standard for Data Center efficiency monitoring. It is the Total building energy/Total IT loads. The idea is that the IT load should be the predominant consumer with the rest of the building loads as low as possible. IT loads that come into DIT's data centers can be handled more efficiently and helps the other state agencies lower their energy consumption.

The WDC PUE has been as low as 1.68 to a high of 1.85 this past year and has trended upward in recent months due to the lower IT load and the spring/summer projects.

Progress

Consumption has dropped to 17% over 02/03 btu/sf levels. This is the best we have been since 05/06. Note: In the early 2000's DIT was a much smaller agency that did not house the number of servers and IT equipment that we do today. That fact greatly contributes to the difficulty in achieving EO80 requirements, however that in no way prevents us from working to reduce consumption as much as we can while maintaining Data center reliability.

	energy evaluation						water/sewer evaluation				
	energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
02/03		$3.73	$13.67		272,914			$1.90		58.03	
03/04	-$13,911	$4.17	$14.72	8%	282,930	4%	-$1,504	$1.69	-11%	67.46	16%
04/05	-$36,880	$4.30	$14.31	5%	300,237	10%	-$1,551	$1.71	-10%	67.63	17%
05/06	-$83,065	$5.09	$15.44	13%	329,943	21%	$85,297	$15.63	722%	0.17	-100%
06/07	-$146,910	$6.09	$16.60	21%	366,747	34%	$53,728	$9.88	420%	0.37	-99%
07/08	-$123,483	$5.58	$17.37	27%	321,172	18%	$94,500	$12.58	562%	7.03	-88%
08/09	-$285,594	$6.74	$17.92	31%	375,794	38%	-$11,655	$5.46	187%	71.82	24%
09/10	-$336,266	$7.03	$18.24	33%	385,416	41%	$8,572	$7.43	291%	50.99	-12%
10/11	-$439,696	$7.72	$18.45	35%	418,371	53%	-$4,351	$7.54	297%	61.56	6%
11/12	-$368,901	$7.48	$19.15	40%	390,467	43%	-$4,246	$8.18	331%	61.20	5%
12/13	-$336,030	$7.40	$19.59	43%	377,583	38%	-$1,587	$8.21	332%	59.21	2%
13/14	-$298,519	$7.41	$20.48	50%	361,852	33%	-$9,858	$9.39	394%	64.44	11%
14/15	-$283,613	$6.93	$19.04	39%	363,819	33%	-$13,509	$9.44	397%	66.77	15%
15/16	-$338,243	$7.91	$21.42	57%	369,266	35%	-$29,807	$10.18	436%	75.90	31%
16/17	-$252,457	$7.16	$20.59	51%	347,729	27%	-$24,755	$10.42	448%	72.53	25%
17/18	-$254,542	$6.87	$19.49	43%	352,622	29%	-$20,913	$10.64	460%	70.03	21%
18/19	-$294,877	$7.39	$20.47	50%	360,839	32%	-$37,215	$11.39	499%	77.97	34%
19/20	-$153,011	$6.56	$20.62	51%	318,196	17%	-$25,726	$10.84	471%	72.51	25%

NC DIT Western Data Center
Energy and Water Management Plan Mandate

The Department Heads will review progress and results annually and will support staff attendance at training in energy and water management.

Our tracking measures will be the following Key Performance Indicators (KPI):
Total Energy Use Btu per Square Foot per year
Water gallons per Square Foot per year
Power usage effectiveness

Commitment

We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility. The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

Strategic Energy Management Plan Mandate- Commitment

I have read and support the Strategic Energy Plan for my Organization Implemented this __ day of ____

Facilities Manager DocuSigned by: Tony Brackett 064DCE1867E9474... Date 8/26/2020 | 1:26 PM

Operations Director DocuSigned by: Henry Kaylor BB7BB0435C254C8... Date 8/26/2020 | 2:06 PM

Chief DSCIO DocuSigned by: Susan Kellogg EE3F24D45A644DE... Date 8/28/2020 | 8:07 AM

North Carolina Department of Military and Veterans Affairs

Agency Utility Management Plan

2019-2021

Prepared by Cecil Holt, DMVA Energy Manager
8-29-2020
With Military Installation Information provided by:

Paul Berry	**Robert Johnson**
SgtMaj, USMC (Retired)	SgtMaj., USMC (Retired)

Program Development Installation Coordinators
NC Department of Military and Veterans Affairs

Purpose

To provide Secretary Hall of the North Carolina Department of Military and Veterans Affairs & Department of Environmental Quality information on Executive Order No. 80.

> *"The North Carolina Department of Military and Veteran Affairs is the newest state government agency and we are dedicated to helping our veterans and active duty men and women access the programs, benefits and resources that they earned when they took the oath and answered the call to service. Our staff is committed to providing the highest level of service, responsiveness and integrity in keeping with the principles and values of this state and nation that our military and their families deserve. "*
>
> *Larry D. Hall, Secretary of Department of Military and Veteran Affairs*

Overview

- DMVA is a State agency that assists with the management of 4 military Skill Care Nursing Homes housing 449 veterans and are currently in the construction phase of 1 - 120 Bed Home & plans to build a 6th Home to provide additional housing for veterans in the state.
- North Carolina has one of the largest military footprints of any state in the country, representing three out of the four branches of service and totaling 129, 049 in 2016. Military and defense industries are the second largest employers in our state, and the military has an economic impact of $66 billion annually. The military bases located in North Carolina are major drivers in our communities, allowing families and business to thrive through the synergy and partnerships that have developed between local and state government, military and defense sectors, and local businesses throughout our history.

Utility Management Plan Goals

Department Veterans Affairs Nursing Homes

Salisbury State Veteran Home

- ➢ Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- ➢ Investigate feasibility of Solar Powered Water Heater System
- ➢ Add Light Diming functions to Resident Rooms.
- ➢ Investigate how to monitor utility consumption on site

- Will request Design Proposal to add Isolation Wing in response to COVID Pandemic, with Negative Pressure Equipment Features to Home in effective yet energy efficient manner.
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.

Fayetteville State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System
- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request Design Proposal to add Isolation Wing in response to COVID Pandemic, with Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Black Mountain State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System
- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request proposal to add Isolation Wing in response to COVID Pandemic, Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Kinston State Veteran Home

- Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.
- Investigate feasibility of Solar Powered Water Heater System

- Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System.
- Existing Shingle Roof Replacement will be with Metal
- Investigate how to monitor utility consumption on site
- Site walkthrough with State Energy Office to look for additional low/no cost projects
- Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.
- Will request proposal to add Isolation Wing in response to COVID Pandemic, Negative Pressure Equipment Features to Home in effective yet energy efficient manner.

Kernersville State Veteran Home (Construction Phase)

- In response to COVID Pandemic, a Change Order will was approved to add Isolation Wing with Negative Pressure Equipment features to Home in effective yet energy efficient Specification and Design.
- Being built to current Energy Codes.
- DMVA did participate in the Duke Energy New Construction Energy Efficiency Design Assistance Program provided by the Weidt Group.
- Investigate how to monitor utility consumption on site

Raleigh State Veteran Home (Proposed)

- If funding is approved the intent is to have a Solar System as a Base Bid program item.
- Investigate Green Roof System as a alternate program item.
- Will be designed & built to current Energy Codes.
- Will participate in the Duke Energy New Construction Energy Efficiency Design Assistance Program provided by the Weidt Group.
- Investigate how to monitor utility consumption on site

Department of Military & Veterans Affairs Cemeteries

Western Carolina State Veterans Cemetery

- Seek funding to install an energy efficient irrigation system in place of staff manual watering system.
- Research funding and options to retrofit lighting to LED fixtures.

Coastal Carolina State Veterans Cemetery

- Seek funding to replace existing irrigation System with an energy efficient system.
- Research funding and options to retrofit lighting to LED fixtures.

Sandhills State Veterans Cemetery

- Seek funding to install an energy efficient Irrigation system in place of staff manual watering system.

- Research funding and options to retrofit lighting to LED fixtures.

Military Installations in NC

"The chief priority of the Department of Defense (DoD) energy policy is to ensure the mission readiness of the armed forces by pursuing energy security and energy resilience. In today's technology-dependent environment, energy is inextricably combined with the Department's missions, from the directly employed weapons systems to the installations and systems that support missions around the globe. In this environment, energy resilience, which enables the capabilities of weapons platforms, facilities, and equipment, is a critical investment that must be part of the Department's research, acquisition, operations, and sustainment conversations."

Camp Lejeune

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Coast Guard's Base Support

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Fort Bragg

- Site visits or teleconferences to connect with the energy manager on site
- Determine installations strategy energy security and sustainability goals
- Collaborate to share best practices and knowledge gained from energy and water initiatives

Seymour Johnson Air Force

- Site visits or teleconferences to connect with the energy manager on site to determine installations strategy energy security and sustainability goals.
- Collaborate to share best practices and knowledge gained from energy and water initiatives

The attached following documents display the efforts the installations are taking in regards to Energy and Energy Resilience Plans. Provided by

a. Department of Defense Operational Energy Strategy Implementation Plan. This document provides the overarching guidance to the uniformed service components. Each uniformed service component then builds their own Energy Plan/Strategy.
b. Depart of the Navy (DoN) Installation Energy Resilience Strategy. This document provides guidance and direction to the Navy and Marine Corps on how to develop each installation energy plan. This strategy provides further guidance

and direction on the proper use of energy when the uniformed are training and during combat operations. The Army, Air Force, and Coast Guard have very similar plans.

c. Marine Corps Installations East (MCIE) Energy Plan. This is a great example of a local plan here in NC. Camp Lejeune and Marine Corps Air Station Cherry Point both recently converted from coal fired hot water plants to natural gas. Every Battalion and Squadron level command has an Energy Manager. Their duties direct them to monitor the energy consumption both in garrison and during field training environments. Social media is used heavily to educate all personnel on how to properly use and conserve energy. An example if when there is a major holiday assigned personnel ensure all lights and office equipment are tuned off. These efforts have proven to be big cost savers over time. Military Ocean Terminal Sunny Point (MOTSU), NC is energy independent. They have a state of the are solar farm that provides most of their energy. I have requested details from them about this project and I will share it with you.
d. MCIE Energy and Water Strategy. I was at this command when this strategy was written. This is an example of a well written plan that is easy to implement and monitor.
e. Joint Land Uses Study Seymour Johnson Air Force Base and Dare County Range. These studies have also taken place around Camp Lejeune, Cherry Point, Ft. Bragg, and MOTSU. One of the outcomes of protecting land around military installations is Energy Development.

A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis is currently taking place with the NC Military Installations.

Attached are the following documents that best display the efforts the installations are taking in regards to their Energy and Energy Resilience Plans.

a. Department of Defense Operational Energy Strategy Implementation Plan. This document provides the overarching guidance to the uniformed service components. Each uniformed service component then builds their own Energy Plan/Strategy.
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A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis is currently taking place with the NC Military Installations. This will be after your 1 September deadline but will be shared for situational awareness.

NC Department of Military & Veterans Affairs
Agency Utility Management Plan

- The NC Department of Military & Veterans Affairs recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and Water management is the responsibility of the staff at each facility, which will be guided and supported by the Energy Manager Designee for NC DMVA.
- The Department of Military & Veterans Affairs has implemented an Agency Utility Management Plan.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.
- The Department Secretary's staff will review progress and results and will support staff attendance at training in energy and water management.

Agency Utility Management Plan Goals

- As required in Executive Order 80, NC DMVA will support efforts to reduce by 2025 total energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels and reduce state-wide greenhouse gas emissions to 40% below 2005 levels.

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Military and Veterans Affairs. The plan, as presented, supports the reduction goals in Executive Order 80. Implemented this 1st day of September 2020

Energy Manager

Larry D. Hall, Sec.
Department Secretary

Appendix A

Sample Utility Management Plan

2019-20

Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect EE strategy toward 40% reduction in Btu/gsf.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2019-2020 Planned Activities	Expected Measurement	Assigned To	Occurrence
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Monthly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager and staff	Due March 1, 2019, thereafter October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	(add dates of training)
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager and staff	May, 2019
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager and staff	May, 2019
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager	Quarterly

2019-2020 Planned Activities	Expected Measurement	Assigned To	Occurrence
Track utility data	Record monthly utility data for annual utility report to submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year

2019-20

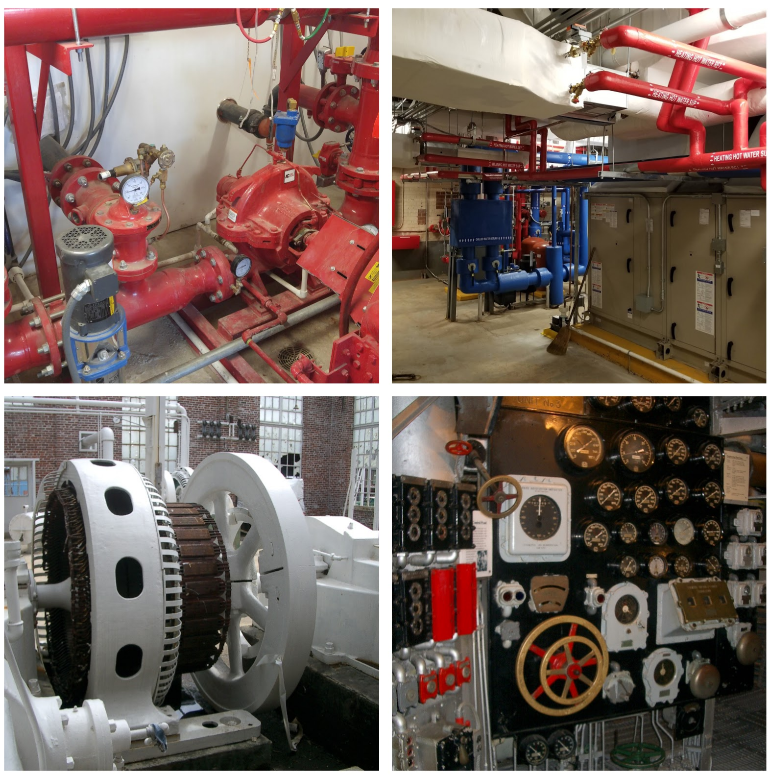
Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Create a schedule for projects to be implement during the fiscal year
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	Expected Measurement	Assigned To	Occurrence
Research lighting retrofit or replacement opportunities in Retirement Homes	Replacement of T12 Bulbs to T8 Bulbs to capitalize on potential energy savings. Seek funding to replace existing T12 Fluorescent Fixtures to T8 LED fixtures.	Energy Manager	Ongoing
Investigate feasibility of Solar Powered Water Heater System	Determine if installation of solar powered water heating system feasible.	Energy Manager and Agency Staff	Ongoing
Investigate feasibility of Power Company LED/ Solar Light Pole Leasing Program.	Determine if lighting can be upgraded on pole lighting by utility company	Energy Manager and Agency Staff	Ongoing
Investigate Heating Ventilation & Air Conditioning System replacement with an Energy Conservation System	Determine which units can be retrofitted or upgraded to more energy efficient units	Energy Manager	Ongoing
Investigate how to monitor utility consumption on site	Determine the best method to track utility data	Energy Manager	Ongoing
Site walkthrough with State Energy Office	Look for additional low/no cost projects	Energy Manager and staff	Ongoing

Educate and engage employees in best practices	Educate and engage employees in energy conservation best practices through meeting presentations, emails, Intranet web sites, etc.	Energy Manager and staff	Ongoing
Building New Retirement Homes to current Energy Codes.	Design and build new facilities to be energy efficient.	Energy Manager and staff	Ongoing
Participate in Duke Energy New Construction Energy Efficiency Design Assistance Program	Participate in the program provided by the Weidt Group.	Energy Manager and staff	Ongoing
Lighting retrofits at cemetery.	Research funding and options to retrofit lighting to LED fixtures.	Energy Manager and staff	Ongoing

NORTH CAROLINA
DEPARTMENT OF
NATURAL & CULTURAL RESOURCES

Strategic Energy and Water Management Plan North Carolina Department of Natural and Cultural Resources



Prepared by:

NC-DNCR Energy Management Team
109 East Jones Street
Raleigh, North Carolina 27601
August 2020

PURPOSE

The Department of Natural & Cultural Resources finds that public buildings can be built and renovated using sustainable, energy efficient methods that save money, promote environmental sustainability, and make employees more productive. The main objective of this plan is to develop a strategic initiative which will evaluate departmental energy and water usage, identify inefficient buildings and systems, and determine measures to correct inefficiencies, establish corrective action priorities, identify funding sources, implement corrective actions, and ensure that corrective action results meet or exceed performance specifications. The goals of the Department's plan should create buildings that at a minimum, meet the specific performance criteria and goals for sustainable, energy and water efficiency as mandated by senate bill 668 and Executive Order No. 80. Our plan will be considered successful when sustainable, energy efficient buildings avoid depleting the resources of energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create buildings that are livable, comfortable, safe, and productive.

OVERVIEW

The Department of Natural & Cultural Resources spent $6,200,000 in FY 2017-18 on energy and water resources. A well-executed long-term energy efficient plan could result in cost savings of 10% or greater annually, which could lead to significant long-term operation cost savings.

The Department is responsible for the operation and maintenance of approximately 1,825 buildings per State Property Office. The Department's building inventory includes historic structures (primarily houses), museums, amphitheaters, administrative offices, support & maintenance buildings, the North Carolina Zoo, State Park facilities, Aquariums and the USS North Carolina Battleship. At least half of the buildings are more than 30 years old, with over 100 built before 1900. Only around 25 structures are larger than 20,000 gross square feet.

This plan will initially focus on identification of major energy and water consumers, which will most likely be existing major facilities (20,000 square feet or larger) with older less efficient systems. The Department will work closely with the State Energy Office and energy consultants to identify measures to correct major inefficiencies. It is anticipated that major renovations & upgrades will require significant funding. Low or no cost actions will be implemented as soon as possible at all facilities. A comprehensive energy & water efficiency awareness & training program will be established for employees. The Department will seek to train facility maintenance personnel on innovative and low-cost techniques to lower energy and water consumption for their specific site.

This plan will also implement sustainable, energy efficient standards for design and construction for new facilities, improvements in lighting systems, reduction of water usage, implementing high efficiency HVAC systems, utilization of energy conservation measures, and environmental sustainability.

FY 2020-2021 GOALS

- Reduce energy consumption per square foot towards the goal of a 40% decrease in comparison to FY 2002-2003 levels, consistent with Executive Order No. 80.
- Conduct informal energy audits on highest energy consuming facilities in the Department to identify energy cost saving measures to reduce consumption by FY 2020-21.
- Continual annual self-audit procedure and checklist for Departmental facilities to identify low or no cost energy saving initiatives to reduce consumption in FY 2020-21.
- Establish annual energy and water usage reporting form to more accurately collect data and determine seasonal trends. Conduct assessment and evaluation of individual sites and energy billing rate schedules.

DATA MANAGEMENT

Current base year for Department data is FY 2010-11. Goals for energy reduction are based on comparison to 2005 levels.

- Merge additional data for former Natural Resource sites (State Parks, Zoo, etc.) for the years before 2010-11.
- Project Cultural Resource sites for the years before 2010-11.
- Research data management options, such as bill paying services to ensure more accurate utility data.

NEW CONSTRUCTION AND RENOVATIONS

New construction of facilities, even at current minimum standards will perform at better btu/ft² levels than existing buildings in the department's portfolio.

- New Visitor Center and Museum at Fort Fisher State Historic Site (in design)
- New Underwater Archeology Building at Kure Beach (in design)
- New Addition to the Museum of History in downtown Raleigh (in design)
- New HVAC system at the Tryon Palace Main Building (completed 2018)
- South Mountains State Park Visitor Center, R-22 substitute refrigerant study
- Various Connect NC bond projects with State Parks
- Roof repair projects will include increased insulation value where applicable
- A third-party firm is conducting a study of the Department's largest energy users to investigate the feasibility of combining multiple sites into a Performance Contract.

OUTREACH AND SUSTAINABILITY

Energy Management will continue to focus on demand-side management by implementing low/no-cost conservation and energy efficiency measures first.

- Adopt best-practice strategies to reduce energy usage at NC-DNCR sites throughout the State
- Develop sustainability policies that emphasize reuse and reduction of consumables
- Support sustainability initiatives through electronic materials and signage at waste stations
- The DNCR Environmental and Energy Performance Committee meets monthly including members from each division in the Department.

ENERGY MANAGEMENT PLAN BUY-IN

GOAL to accomplish the following by the year 2025:
Reduce annual Total Energy Consumption by a minimum of 40% from a baseline established in fiscal year of 2002-03, consistent with Executive Order No. 80.

MEASURES
Our tracking measures will be: Total Energy Use in Btu per Square Foot per Year

COMMITMENT

- We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility, guided and supported by the Utility Manager and Utility Savings Initiative (USI) Liaison.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.
- The Division Heads will review progress and results and will support staff attendance at training in energy and water management.

DEPARTMENT OF PUBLIC SAFETY

CENTRAL ENGINEERING

Plan • Design • Construct

EXECUTIVE ORDER 80 ENERGY & WATER MANAGEMENT PLAN

Revision 1

SEPTEMBER 16, 2020

CENTRAL ENGINEERING
2020 Yonkers Road, Raleigh, NC 27699

Executive Summary:

GS 143-64 requires all agencies reduce energy and water *intensity* by 30%[1] by 2025. Governor Cooper's Executive Order 80 increases this requirement to 40%[2] by FY 2025-2026. NCDPS is struggling to attain these targets (see **Graph 1A** and **1B**) even though efforts have intensified substantially since FY 2017-2018 (**Appendix A**). NCDPS currently stands at an 19 % energy and 12 % water reduction compared to FY 2002-2003[3]. By comparison, the department *peaked at a 22% and a 23% reduction respectively in FY 2016-2017. The department's annual* water & sewer expenditure is about the same as electricity - and even higher for correctional facilities*. For this reason, the focus must be equally on energy and water reductions in intensity. A challenge to reducing intensities is that ~40% of correctional spaces are not air conditioned and lack sufficient security lighting; moreover, when NCDPS begins addressing these basic operational shortfalls, it will only serve to delay achievement of the targets.*

Attaining these targets requires aggressive action:

- Saving approximately 87 MMBTU every year for the next six years based on current usage intensity.
- This translates to investing approximately *$13.5M* a year in water and energy efficiency projects[4], or $81M over the next 6 years. Projects both funded and unfunded needed to attain these targets are provided in **Appendix B**. *Aggressive leak detection and repair could noticeably reduce overall project funding needs.*
- Hiring additional staff to manage these projects and properly maintain facility systems.
- Leadership buy-in and promotion of commission-based maintenance over break-fix.

Legislation like HB 1292[5] for cabinet agencies would accelerate these efforts. Several universities have taken advantage of this bill and have surpassed the desired 40% reduction in water & energy intensity.

Attaining these targets have tremendous tangential benefits:

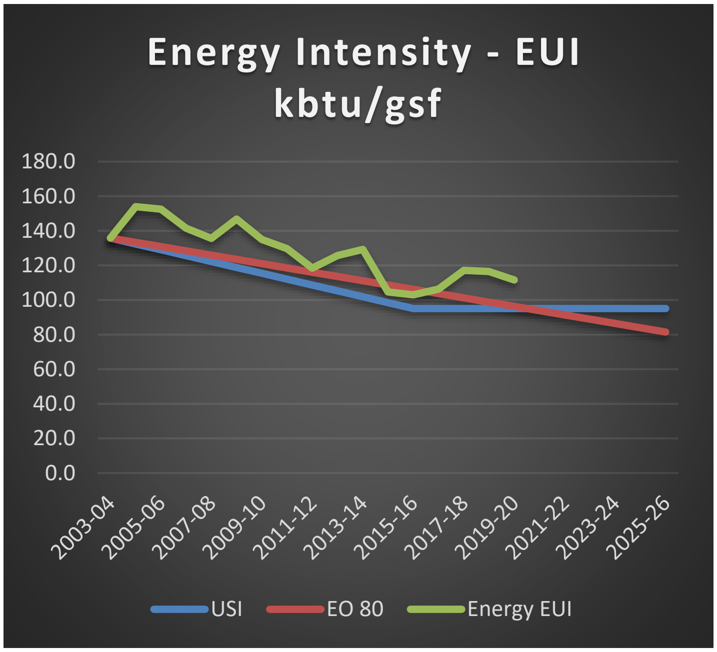
- Improved security and safety of our Adult Correctional and Juvenile Justice officers and staff, and adult and youth offenders.
- Reduced deferred maintenance.
- Reduced maintenance requirements.
- Improved occupancy comfort (temperature and visual),
- Prolonged equipment life.
- 15% or better ROIs. *How many departments can pay for their salaries through their savings?*

Attaining these target reductions are challenging for several reasons:

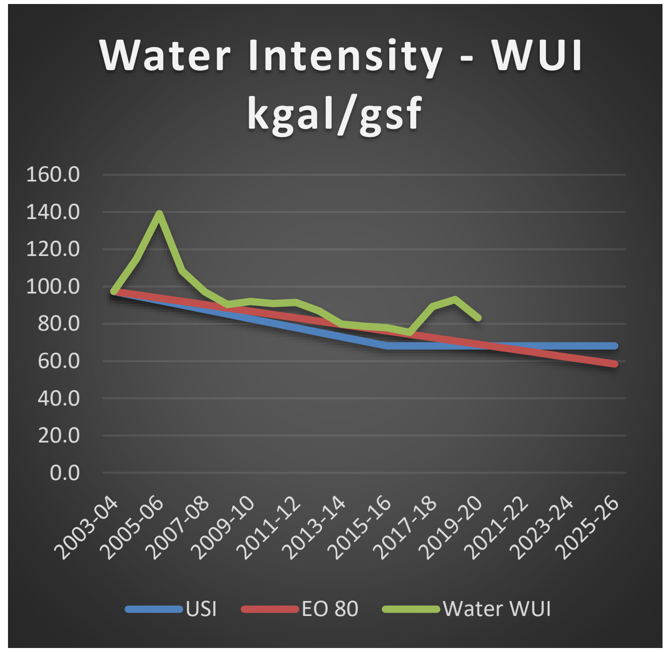
- Insufficient energy management and maintenance staffing.
- Insufficient funding with energy and water efficiency projects competing with other Repair and Renovation needs such as leaking roofs, failing infrastructure and mechanical & electrical systems.

[1] Session Law 2008-203/Senate Bill 1946: Intensity is the energy and water use per square foot.
[2] Compared to our energy/water intensity (usage per gross square foot) in FY 2002-2003. See also Footnote 3.
[3] There is insufficient data to establish a FY 2002-2003 baseline. So, FY 2003-2004 is being used. See also Footnote 2.
[4] This is an "order of magnitude" estimate. Our current level of project investment is $1M a year, or around 10% of what is required.
[5] HB 1292 allows universities -but not other state agencies - to use energy efficiency savings from completed projects for new energy efficiency projects. Utility budgets are maintained at "pre-energy efficiency project" funding levels.

- No building management system (BMS) standards and insufficiently trained staff to proper manage these systems.



Graph 1A



Graph 1B

Accomplishments FY 2019-2020:

Funding:

Opt-Out funding peaked this year at close to $1.2 M. *This will decrease over time due to site closings and reduced energy usage.* From the inception of our program to present over $2.4M in credits have been received.

Analyses:

- NCDPS' utilities database, Capturis, issues "fatal exceptions" whenever usage increases by 50% as compared to the same month in the past year. Emails are faithfully sent to these facilities staff at these sites requesting investigation of these issues. Otherwise, uncovering excessive (outlier) energy/water outlier usage is like looking for a needle in a haystack. The latest (August 2020) version Energy/Water Analytics Dashboard now pinpoints sites trending in the wrong (or right) direction at-a-glance.
- Oil and Propane are commodities – not utilities. This data must be carefully extracted from the NCAS system. As of FY 19-20 propane bills are now entered into Capturis partially simplifying the task. Fuel Oil bills still require careful review.

Finally, rate analyses (electric and third-party natural gas) are now on an annual review to always ensure the most cost competitive rates are used.

Staffing: Energy Management: The team has increased in size from 1 full time equivalent employees (FTE[6]) to 2.75 FTE with the hiring of a project manager for exterior lighting projects and a ¾ time college intern. These positions are temporary employees funded through Opt-Out credits and subject to disruptions created by frequent turnover. Adult Corrections (AC) is in the final stages of hiring an Energy & Sustainability Manager for the Department of Prisons. These hires will accelerate our interior lighting projects, allow us to formally develop a water leak detection, and, maintenance-based commissioning (MBC) program.

- Project Management: Additional support is provided on a 'when available' basis from the Central Engineering project management team. Over the past 12 months, four Small Business Projects have been completed by a project manager, yielding the equivalent of a ¼ FTE for the Energy Program.

[6] We cannot hire full time staff. Opt-Out funds are being used to hire additional staff from Temporary Solutions to develop sufficient bandwidth to execute more projects. However, temporary employees have little incentive to remain in temporary positions.

Projects:

Exterior Lighting: Since FY 2017-2018 over $1.9M has been spent and over 1,180 perimeter and 725 wall pack LED fixtures installed at our Correctional and Juvenile Justice facilities. 23 sites have been improved by these projects and of these 6 sites are completely retrofitted with LED exterior lights.

Interior Lighting: Since FY 2017-2018 over $506k has been spent on interior LED lighting retrofits for 21 sites.

Four sites have had comprehensive audits and retrofits under Duke Energy's Small Business Energy Savers (SBES) program. NCDPS spent $190k to receive a matching $285k in rebates as Duke covers 60% of the retrofit cost under this program.

Building Management Systems (BMS): Phase I of the BMS Design Guidelines is complete and being implemented on current and new projects. The design for upfitting Nash CI's BMS in accordance with the new BMS design guidelines is complete.

Water Leaks: The average age of our facilities is over 50 years and water leaks are a major issue. In FY 2018-2019 over $600k in water and energy savings occurred at Nash CI once leaks were repaired. Another major water leak at NCCIW is under investigation with repairs anticipated by November 2020.

Programs: All lighting purchases must now be approved by Central Engineering. This ensures we only order LED lamps. LED lamps are more expensive than conventional lamps (fluorescent and otherwise). Energy Management is matching funds to ensure energy efficient LED lamps are ordered.

Goals FY 2020-2021:

Funding:

As noted earlier Opt-Out credits have peaked due to operational consolidations and reduced energy usage. NCDPS is aggressively taking advantage of every funding option available by:

- Opting-Out of Renewable Energy Portfolio (REP) duplicate credits which will result in about $20,000 in additional credits. The overall impact of total credits received this year should be neutral.
- Taking advantage of Duke Energy's SBES Program which offers aggressive rebates up to 70% for turnkey energy efficiency projects (energy audit, cost estimate, purchase and retrofit) for small sites.
- Pursuing sewer credits for water leaks to reimburse the costs of these investigations and repairs.
- Developing a performance contract for Adult Corrections by FEB 2021 for leadership review. It will include completion of exterior lighting retrofits, select sites for interior lighting retrofits, and water management systems. As noted previously, about $11M in yearly funding is needed for energy and water efficiency projects to meet our targets; thus, performance contracting (PC) is the only solution at this time unless a bill is passed similar to HB 1292. PC is an appropriate vehicle for funding projects that emphasize quick paybacks and are narrowly focused in scope and scale.
- Introducing a matching fund program for lighting retrofits with maintenance personnel. Opt-Out funds are being used to split the cost for every light fixture/lamp that is purchased by a local unit. This ensures local units retrofit fixtures/ lamps using high efficiency LEDs rather than conventional fluorescent or high pressure sodium.
- Continuing to rally support for legislation equal or better than HB 1292.

$250k in R&R funds is being requested this fiscal year to support measures that cannot be funded from Opt-Out. If approved, projects are slated for lighting and BMS upfits for our smaller divisions (Juvenile Justice, State Highway Patrol and SBI), and, funds for water leak detection and repairs for our Adult Correction facilities. This presents a continued challenge pitting energy/water efficiency measures against life-safety and security R&R needs.

Analyses:

- The Energy & Water Dashboard will be used to pinpoint and further investigate the top five sites with the best and worst energy intensities since FY 2016-2017 to determine the cause for the decreases/increases. Best practices will be developed from the lessons learned.
- The last of the transportation rate natural gas accounts will be transitioned back to utility purchased gas. Estimated savings will be $100k per year.

Staffing:

- Energy Management: If approved, another ¾ time energy intern (Opt-Out funded) and an assistant energy manager by Fall 2020 will be hired. Central Engineering will assist DOP with onboarding the new AC Energy & Sustainability Manager.
- Maintenance: High performance maintenance can result in energy savings of over 15%. The existing energy management team will strategize with the new AC Energy Manager on how to overcome current personnel shortages and alternative means of addressing this aspect of energy efficiency. An option is to hire centrally

based teams dedicated to Maintenance Based Commissioning (MBC) that focus on water leak detection, and high-performance maintenance.

Projects:

Exterior Lighting: Purchase and install $500k in exterior LED light fixtures this fiscal year. Fixture solutions for the remaining sites (approximately 31) will be completed by July 2021. *If this pace of funding continues, another five years of funding is required to fully convert all our sites to exterior LED light fixtures.* At least three sites will be assisted in having their utility owned exterior lighting converted to LED.

Interior Lighting: Make Foothills CI the first facility with 100% LED lighting for both interior and exterior lighting applications. Fund $145k in interior lighting LED retrofits including SBES projects. Target 15 additional sites for SBES audits. Complete photometric analyses and fixture selections for all interior lighting inmate individual cells and dormitory rooms.

Building Management Systems (BMS): Upgrade the network backbone of the BMS systems at our NORESCO sites (Harnett CI, NCCIW and Nash CI). Begin upfitting Nash CI's BMS in accordance with the new NCDPS BMS design guidelines. Fund an additional $40k for the installation of variable frequency drives. Complete Phase II of the BMS Design Guidelines by focusing on specification performance standards, the layout of the point property pages, summary diagnostic tables, data analytics, and name tagging.

Thermostats: Investigate and deploy where feasible Duke Powe's free programmable thermostat for small businesses throughout the Duke Energy territories.

Water Leaks: Complete major water leak repairs at NCCIW by November 2020 and investigate one other site. Attempt repairs if leaks found. Investigate the use of foot pedals in our kitchens to reduce water usage in these areas.

Programs: Initiate a boiler tune-up and training program.

Challenges

Funding: The Energy Team has the talent and drive to attain these targets but does not have the funds and staff to do so. Compared to other institutions of similar scale, an additional seven staff members are needed. 15%+ ROIs can occur while *reducing deferred maintenance, prolonging equipment life, improving maintainability, and, correctional officer and staff safety.*

Maintenance: Maintenance staffing is down by 18 % and over 88 positions because qualified candidates cannot be hired quickly and paid sufficiently. 15%+ energy savings are possible when maintenance teams are properly staffed and high-performance maintenance occurs. A possible and highly viable solution is for the new AC Energy Manager to create a team dedicated to energy management and Maintenance Based Commissioning (MBC). This would also result in *reduced deferred maintenance, prolonged equipment life, improved maintainability, and, correctional officer and staff safety.*

COVID-19: *The COVID-19 pandemic possibly resulted in a reduction in energy and water usage for all divisions except Adult Corrections. Adult Corrections experienced increases that are possibly due to our clients and their proximity to each other. A deeper dive into each division and each site is required to determine the short- and long-term impact of this pandemic, and how we can still effectively address energy and water efficiency opportunities while doing so.*

Opportunities:

Duke Power Programs: Duke has several programs that may benefit NCDPS in the future. One is a Shared Savings Program which is similar to performance contracting in that there are no up-front costs - just payments from the savings. Duke Power is also upgrading to continuous logging meters which can be viewed via a program they called One View. These opportunities require further evaluation.

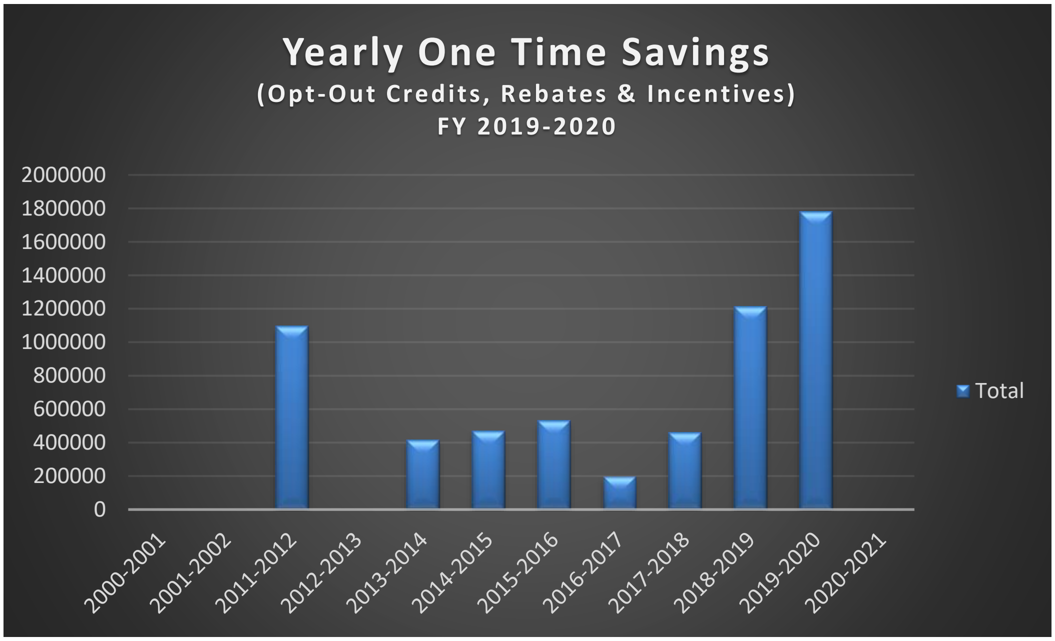
Sustainability: Sustainability can be defined as a means of preserving and enhancing the environment and human quality of life while remaining economically viable. For this reason, sustainability compliments the roles of energy and water managers. The NCDPS program already focuses on human quality of life, security, and economic viability through ROI and reducing maintenance requirements and other opportunities abound. A good start is recycling with a focus on cardboard. Other opportunities are provided in **Appendix C.**

Resiliency, Potential Site Consolidations & Energy/Water Efficiency Impacts: Resiliency can be defined as the ability of NCDPS, its divisions, facilities and staff to proactively face and address more frequent and intense storms, flooding, drought, and, increasing day and night-time temperatures. This includes logistical issues related to relocation of inmates, goods, and services. Many factors impact energy & water efficiency as well as resiliency that should be taken into consideration if further site consolidations are considered. Questions that should be asked include:

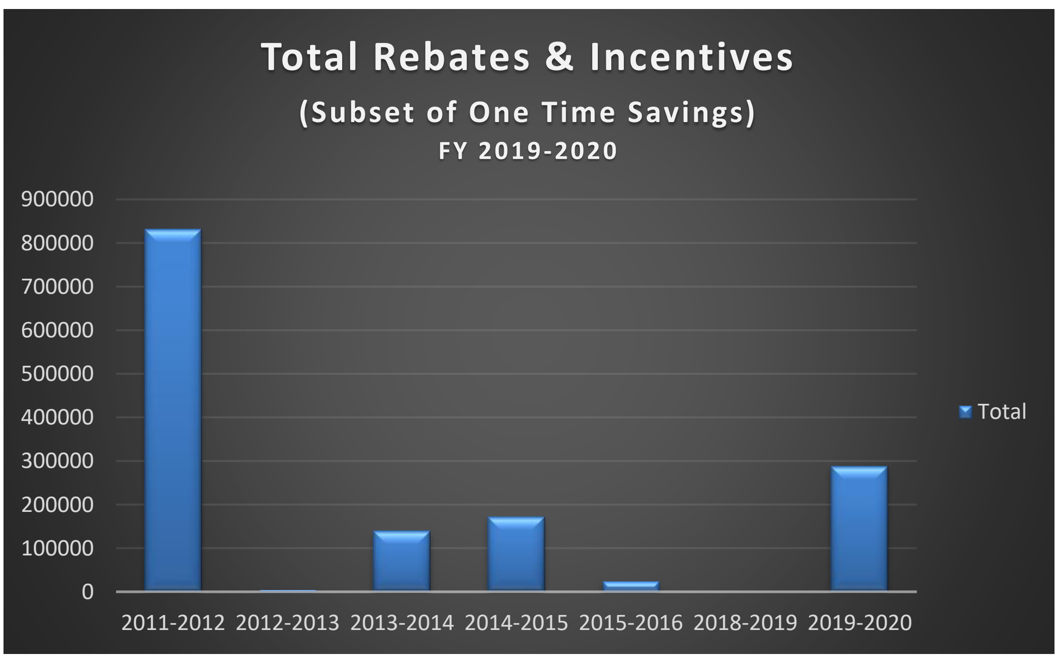
- What sites have the most unairconditioned bed count? (and will require future cooling and energy use)
- What sites have the highest water/sewer, and, electrical costs per unit? (Electric Coops generally have higher rates. Water/sewer rates are generally higher when we are the primary or only industrial/commercial water customer of a water service provider)
- What sites have the oldest facilities and need the most R&R work? (Possible indicator of higher water and energy costs, more poorly insulated buildings, etc.)
- What sites have the most failing roofs? (Can result in poorer indoor air quality due to potential mold issues and reduced energy efficiency due to wet insulation)
- What sites have the oldest, failing infrastructure (electrical and water distribution systems)? (Possible indicator of higher water and sewer costs due to leakage, and cost to upgrade electrical systems)
- What sites have the highest Energy Use Index (EUI - energy use per square foot) and/or Water Use Index (WUI - water use per square foot)? (Relocating to other sites could improve our overall EUI/WUIs and bring us closer to our 40% reduction targets)
- What sites are least conducive to ease of temporary inmate/staff/goods/services relocation? (Higher energy transportation costs and pollution)
- What sites are most prone to excessive and frequency of flooding conditions?

-End-

Relevant Charts

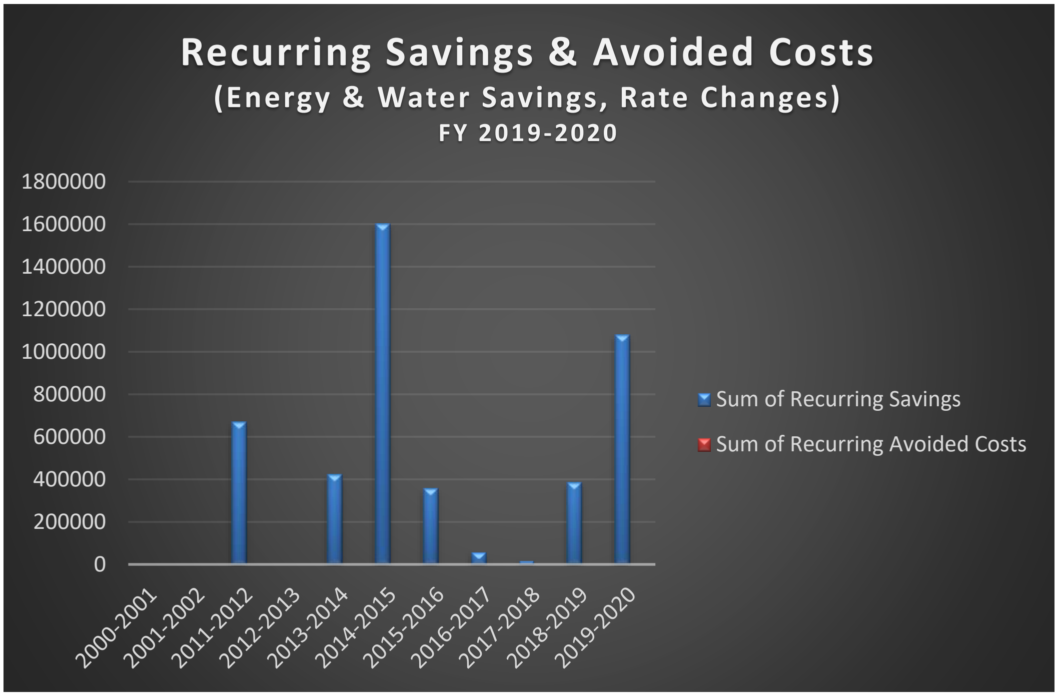


Note increase in Opt-Out credits as the program matured, and rebates/incentives received from Small Business Energy Savers incentives this past fiscal year.

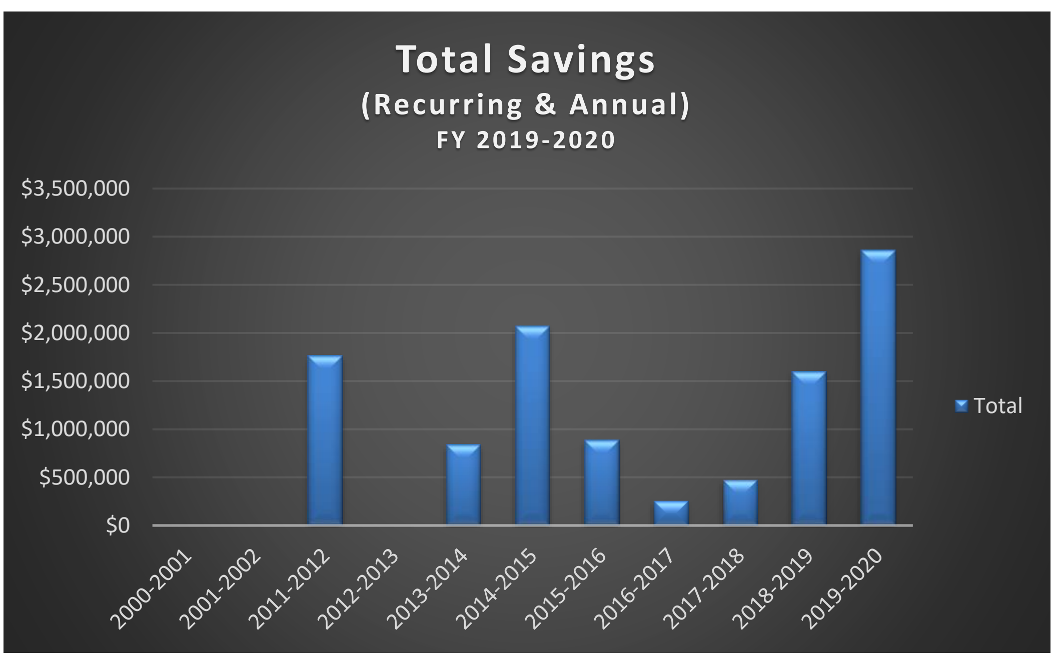


Rebates/Incentives are a sub-set of Yearly One Time Savings. Small Business Energy Savers Program are primarily responsible for FY 2019-2020 increase, though a $32k rebate was received for LED lighting retrofits at Alexander CI.

Relevant Charts

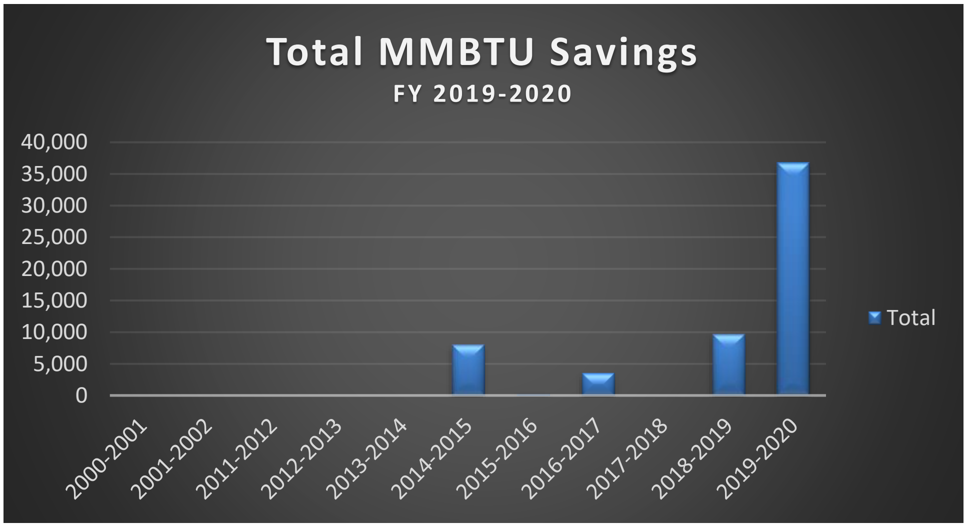


Note increase in recurring savings due to energy/water efficiency. Peaks in 2011-2012 and 2014-2015 reflect the America Recovery & reinvestment Act (ARRA) funded projects and NORESCO projects respectively.



Note increase in yearly savings over the past three years.

Relevant Charts



Note increase in energy savings. Savings not available for most projects prior to FY 2017-2018.

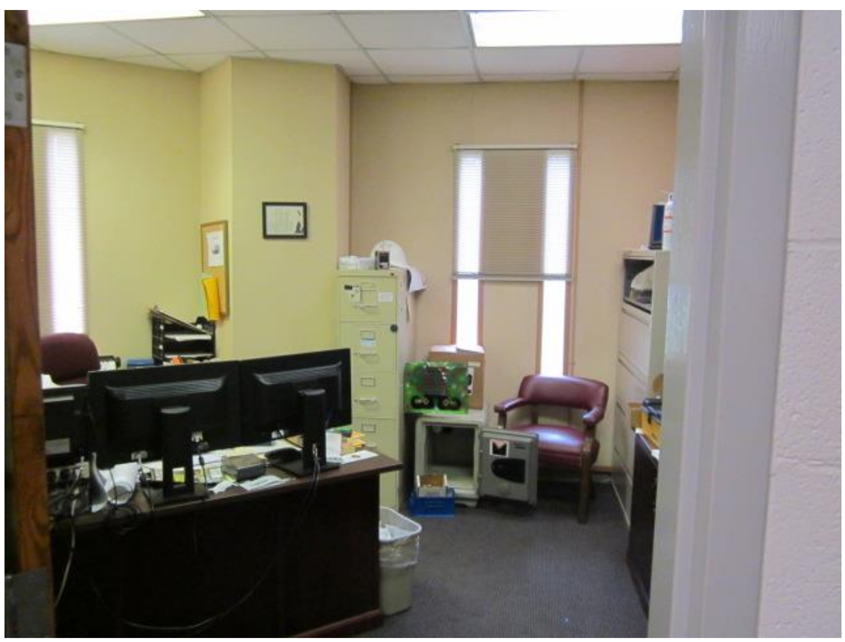
Interior Lighting Retrofit Example:

Southern CI (Special Thanks to Jere Spaun and team for his efforts)

Initial light level:	**46 fc**
Final Light Level	**53.5 fc**
Energy Reduction:	**64%**

Before LED Retrofit

After LED Retrofit



Project improved visual acuity and dramatically reduced the exterior lighting maintenance

Thousand Cell Exterior Lighting Retrofits

Before… **After…**

85% Reduction in Energy Use

Project improved visual acuity, enhanced site safety, and dramatically reduced the exterior lighting maintenance

Special thanks for all the site and regional maintenance team members responsible for installing these light fixtures

Thousand Cell Exterior Lighting Retrofits

Before…

After…

After…

Thousand Cell Exterior LED Lighting

82% Power Reduction

Project improved visual acuity, enhanced site safety, and dramatically reduced the exterior lighting maintenance

Appendix A

Historic Efforts to Attain Energy & Water Reduction Targets

FY	Category	Success
2017-2018	Funding	Opt-Out program started resulting in credits of over $300k
	Staffing	4 Summer Interns hired to expedite projects and analyses.
	Exterior Lighting	$250k in exterior LED lighting purchased.
	Interior Lighting	$18 k in interior LED lighting installed. Additional $12 k in LED lighting purchased.
	Building Management Systems (BMS)	Design Guidelines for building management systems started.
	Water Efficiency	DOP Bus Terminal toilets replaced, meter size reduced: ~$7k yrly savings.
	Analysis	~$100k savings by converting two natural gas accounts back to more cost effective rates. Water & electric meters removed and LED lights installed at Umstead CC ~$23k/yr. ~$6k yearly billing error corrected (Capturis billing),

2018-2019	Funding	Opt-Out program credits surpasses $890 k. ~45k rebate for Nash CI Demand Response Agreement.
	Staffing	4 Summer Interns hired to expedite projects and analyses. Several retained throughout fiscal year.
	Exterior Lighting	~$180k yrly cost savings, Exterior Lighting LED Retrofit replacement program begun.
	Interior Lighting	
	Building Management Systems (BMS)	
	Water Efficiency	
	Analysis	~101k Natural Gas tax fee recovery (Teresa Murphy). Phase I of Utility Analytics Dashboard begun. ~315k yrly savings Natural Gas rate changes.

2019-2020	Funding	Our Opt-Out program resulted in credits of over $1.2 M in FY 19-20
	Staffing	Temporary staffing increased by 2 FTE[7]. One student intern hired for the summer. Central Engineering supplemented our project management staff by approximately .25 FTE
	Exterior Lighting	~212k yearly energy savings and over $1M in exterior lights purchased.
	Interior Lighting	~$184k in yearly energy savings and ~$278k in interior lighting projects including Small Business Energy Savings Program (5 sites) and Led lamp retrofits.
	Building Management Systems (BMS)	BMS Design Guidelines I complete.
	Water Efficiency	~$590k savings from Nash CI water leak.
	Analyses	~85k yearly savings electric rate changes, Phase I Energy & Water Data Analytics dashboard completed.

Appendix B:

Projects Anticipated To Be Funded (Through Opt-Out Credits) and Unfunded Projects Needed to Attain Our Target Reductions.

Project Summary: Funded and Unfunded

Project Summary	Project Costs:	Recurring Savings:	Kgal Reduction	Sum of Total Energy MMBTU
2020-2021				
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
LED Exterior Lighting Retrofit	$597,070	$127,426		5,996
Stormwater Fee Elimination	$1	$29,880		0
2021-2022				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Rockingham Duke energy analyses and savings	$239,042			1,416
Rockingham Duke rebate				0
2022-2023				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
2023-2024				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
2024-2025				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Interior LED Lighting Retrofits	$9,061,169	$5,923,363		264,083
Water Management System = to ICON	$17,065,142	$2,059,024	173,200	0
2025-2026				
Exterior LED Lighting Lamp Replacements	$500,000	$115,696		5,179
Interior LED Lighting Lamp Replacements	$226,000	$125,508		6,548
Water Management System = to ICON	$31,008,198	$3,741,347	314,713	0
Additional HVAC Projects to Attain Goal: Energy	$19,605,668	$4,155,986		185,800
Grand Total	**$81,432,290**	**$17,368,554**	**487,913**	**522,476**

These projects are anticipated to be funded through Opt-Out Funds

These are unfunded projects needed to attain our 40% reductions.

Appendix C: Sustainability Opportunities

Category	Description	Priority	ROI
Land	Native Plantings/Grass		Low
Land	Reforestation		Low
Land	Drought resistant grass		Medium
Land	Xeriscaping, Native plantings, perenials		Medium
Land	Reduce Impervious Areas		Low
Land	Stormwater retention		Low
Farm	No till operations		High
Farm	Reduced chemical Usage		High
Farm	Rainwater capture		Medium
Water Efficiency	BOD Reductions		Medium
Water Efficiency	Water Management Systems		High
Water Efficiency	Low flow aerators		High
Water Efficiency	Low flow flushmeters		High
Water Efficiency	Low flow toilets		High
Water Efficiency	Pressure reducing stations		Medium
Water Efficiency	Leak Detection (including metering) & repair		High
Water Efficiency	(Rain) water reuse		Medium
Energy/Atmosphere	LED Interior Lighting		High
Energy/Atmosphere	LED Exterior Lighting		High
Energy/Atmosphere	Photovoltaics -Leased		Medium
Energy/Atmosphere	Photovoltaics - Owned		Low
Energy/Atmosphere	ZEV/low emission vehicles		Medium
Energy/Atmosphere	ZEV/low emission equipment (lawn care, etc.)		Medium
Materials & Resources:	Local Materials		Low
Materials & Resources:	Lamp Recycling: Bulb crusher		High
Materials & Resources:	Cardboard recycling		High
Materials & Resources:	White paper recycling		Low
Materials & Resources:	Large toilet rolls & dispensers		Medium
Materials & Resources:	Foam Soap Dispensers		Medium
Materials & Resources:	Filter manometers		High
IAQ	IAQ Management & filtration systems		High
IAQ:	Daylight & Views		Low
IAQ:	Green Cleaning - microfiber products		Medium

IAQ:	Green Cleaning - Foam soap, non-antibacterial		Medium
IAQ:	Green Cleaning - products		Medium
IAQ:	Humidity Control		High
IAQ:	Pollution Source Control & Management		Low
IAQ:	Mold reduction		Low
IAQ:	Lead reduction		Low
IAQ:	Asbestos reduction		Low

--End--

NC Department of Revenue

Agency Utility Management Plan

Fiscal Years 2020-2025

Prepared by Business Services and Support
February 2021

Executive Summary

The Department of Revenue (DOR) administers the tax laws and collects taxes due in an impartial, consistent, secure and efficient manner to fund public services benefitting the people of North Carolina. As a cabinet agency, the Department is fully committed to supporting Executive Order 80 and working with other agencies to meet the established goals:

- Reduce statewide greenhouse gas emissions to 40% below 2005 levels
- Increase the number of registered, zero-emission vehicles to at least 80,000
- Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels

This document outlines the agency's Utility Management Plan in support these goals.

Background

The main DOR facility is state-owned and maintained by the Department of Administration (DOA). The DOR also has 13 remote offices across the state which are leased facilities. Actions identified in the utility management plan address initiatives associated with the main building as well as the remote offices. Operationally, the agency will evaluate impacts of climate change on programs with the intention of integrating climate change mitigation and adaption practices into our operations. Participating as a member of the North Carolina Climate Change Interagency Council will provide an opportunity to collaborate and share ideas across agencies to enhance DOR programs and initiatives associated with the executive order.

Utility Management Plan
2020 - 2025

Focus Area 1: Comprehensive Plan	
Strategy 1.	Provide energy saving project recommendations in the DOR Repair and Renovations Request to DOA
Strategy 2.	Update internal plans to reflect energy efficiency strategy and support for Executive Order 80
Strategy 3.	Work with the State Energy Office (SEO) to assist with review of strategy and timeline
Strategy 4.	Continue to provide internal education and update existing marketing plan to support the strategy
Strategy 5.	Implement Plan

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Meet with SEO to develop content for the plan	Discuss the Utility Management Plan content and focus areas	Agency Designee, Energy Manager and SEO staff	As needed
Evaluate operations to identify potential energy savings initiatives	Create list of planned and potential future initiatives to be included in the Utility Management Plan	Agency Designee, Energy Manager and Agency Staff	Annually
Update Utility Management Plan	Complete the plan and timeline for the agency and submit plan to SEO	Agency Designee, Energy Manager and staff	Due March 1, 2021
Participate in Energy Manager meetings with other State Agency's to share ideas	Attend monthly meetings and provide updates on Utility Management Plan progress	Energy Manager	Monthly
Meet with stakeholders and internal teams to implement initiatives included in the plan	Designate a team or teams to implement portions on the plan	Agency Designee, Energy Manager and staff	Quarterly
Update existing marketing and communication program	Continue to improve and implement program	Agency Designee, Energy Manager and staff	Annually
Review Utility Management Plan progress	Review plan; revise and adjust initiatives and timelines as needed	Agency Designee, Energy Manager and staff	Quarterly
Update R&R Requests to recommend energy saving projects to support Executive Order 80	Work with DOA to help prioritize recommended energy saving projects.	Energy Manager and DOA	Annually

Focus Area 2: Initiatives to Implement	
Strategy 1.	Review opportunities with staff to determine high priority initiatives
Strategy 2.	Work with staff to determine the best timeframe to implement initiatives
Strategy 3.	Create a schedule for planned initiatives
Strategy 4.	Communicate initiatives to staff
Strategy 5.	Implement initiatives

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
HVAC improvements	Support DOA in installing new fans in primary air handling units	Energy Manager and DOA	FY 2022
Evaluate aging equipment in various areas and develop a master plan for replacement	Replacement of aging equipment based on funding availability (CRAC Units replaced in Scan Room and UPS replacement)	Energy Manager, DOA and staff	FY22 – CRAC Units FY25 – UPS Replacement
Downsize Headquarters Data Center footprint	Continue consolidating server equipment to save energy in our Data Center	Energy Manager and staff	Ongoing through FY23
Modify lighting timers at HQ facility	Work with DOA to have lighting timers adjusted by floor to cut down on light usage	Energy Manager and DOA	May 2021
Promote teleworking; review and revise agency telework policy	Updated telework policy; Continued replacement of desktops with laptops	Agency Designee and staff	Annually
Continue to evaluate potential use of ZEVs	Review use of long term lease and motor fleet vehicles; Review and update internal policies	Agency Designee and staff	Annually
Promote electronic filing	Increase in electronic filing, reduction in time scanners operate	Agency Designee and staff	Annually

Focus Area 3: Marketing and Communication Plan	
Strategy 1.	Identify marketing and communication initiatives
Strategy 2.	Work with team to identify delivery methods
Strategy 3.	Create a schedule for marketing and communications
Strategy 4.	Develop and Implement initiatives

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Maintain internal employee education campaign	Employee awareness of Executive Order 80 and opportunities to support energy efficiency	Agency staff	Annually
Update marketing plan for electronic filing	Identification of action items to support increased electronic filing	Agency staff	Annually

Focus Area 4: Remote Office Energy Savings (Leased Facilities)	
Strategy 1.	Identify opportunities to downsize leased space
Strategy 2.	Work to identify jobs eligible for permanent teleworking
Strategy 3.	Develop and Implement Initiatives

2020-2025 Planned Activities	Expected Measurement	Assigned To	Occurrence
Downsize the footprint of Charlotte Office	Move from occupying 24,000 square feet to less than 10,000 square feet.	Agency Designee and staff	FY22
Close Service Center in Winston Salem	Transition employees from the Winston Salem office to other offices, or move employees to permanent teleworking.	Agency Designee and staff	FY21
Analyze space needs for remaining remote offices to identify opportunities to reduce footprint	Reduction in square footage for remote offices as leases expire	Agency Designee and staff	Annually

Agency Accomplishments since March, 1 2019

- In 2019, the Department of Revenue supported the Department of Administration (DOA) in making HVAC upgrades to the main DOR building. The project included replacement of the outdated controls tied to the HVAC system. This project supports the Executive order by making the HVAC system more energy efficient as well as make it easier to regulate temperature throughout the facility.
- The Department of Revenue funded and upgraded lighting in several locations throughout the main facility. These changes included moving from high energy use lighting to LED lighting in the rotunda areas on each floor and the secretary's conference room. The agency continues working with DOA to move towards replacing lights in other areas of our main building with LED lighting.
- The Department of Revenue funded and upgraded several outdated Power Distribution Units (PDU) throughout the main facility. With the assistance of DOA, the agency has a better utilized power distribution system, one less PDU, and a better source of redundant power to critical equipment.
- The Department of Revenue funded the replacement of outdated computer room air conditioning (CRAC) units located inside the main data center. With the assistance of DOA, one CRAC unit inside the Data Center was downsized resulting in better utilization and efficiency of air flow. The new CRAC units work together with a digital network connection that can turn off or slow down the speed in which the CRAC units cool (not always running at 100% cooling). The older units did not have the ability to regulate the temperature in the same way. The new equipment is helping save energy while still accommodating temperature requirements inside the data center.

Newly installed equipment inside of our Data Center

- The most significant impact this thus far has been the agency's increase in teleworking. A new policy was created and implemented. In March 2020, an estimated 5% of the agency was part-time or full time teleworking. As a result of Covid-19, the agency quickly took action to move employees to teleworking while maintaining agency operations and service levels. To date, approximately 90% of employees are teleworking. Due to the number of employees able to telework, overall power usage in the main facility has been reduced.

- The Department of Revenue has been able to transfer the majority of long term rental vehicles to hybrid vehicles and continues focusing on switching out the remaining vehicles.
- The Department of Revenue created an internal employee education program about Executive Order 80 to include posters throughout all facilities as well as Intranet postings. The Digital Communication Division maintains an Electronic Filing Marketing Plan with the objective of increasing electronic filing for individual and business taxes. For tax year 2019, electronic filing increased by 3% for Individual Income Tax, 6% for Corporate Tax, and 9% for Partnership Tax. Increased electronic filing results in lower power consumption by the high speed scanning equipment.

NC Department of Revenue
Agency Utility Management Plan

- The NC Department of Revenue recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and water management is impacted by all employees and the responsibility of the Energy Manager for Department of Revenue with support from the Department of Administration.
- The Department of Revenue has developed an Agency Utility Management Plan. The Assistant Secretary of Business Services and Support is responsible for the success of the program for Department of Revenue.
- The Agency Utility Management Plan outlines the activities identified to support reduction in energy and water consumption goals with support from the Department of Administration.
- The Department will review progress and results and will support staff attendance at training in energy and water management**.**

Agency Utility Management Plan Goals

- As required in Executive Order 80, NC Department of Revenue will support efforts to reduce energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels and reduce state-wide greenhouse gas emissions to 40% below 2005 levels.

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Revenue. The plan, as presented, supports the reduction goals in Executive Order 80.

Implemented this 28th day of February 2019
Updated this 24th day of February 2021

3/1/2021

Matt King
Agency Energy Manager
Date

3/1/2021

Angela W. Altice
Assistant Secretary, Business Services and Support
Date

3/4/2021

Ronald G. Penny
Secretary, Department of Revenue
Date

NC Department of Transportation

Agency Utility Management Plan

Fiscal Years 2019-2021

2020 Agency Utility Management Plan

North Carolina Department of Transportation

Table of Contents

Executive Summary

This NCDOT Agency Utility Management Plan (AUMP) has been developed in accordance with N.C. Gen. Stat. 143-64/12(a), and has been updated to support the achievement of goals outlined in Sections 1 and 8 of Executive Order 80 - NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY. The intent of this plan is to support environmental stewardship and reduce the impact of utility usage in NCDOT-owned buildings upon the climate through the responsible use of utilities. This Plan reports FY 2019-2020 utility usage and trends, and summarizes NCDOT strategy and programs supporting legislative and Executive Order 80 goals for fiscal years 2019 - 2021.

This report is updated biennially, and outlines ongoing energy savings programs that will reduce NCDOT energy consumption per square foot in DOT buildings by 40% from fiscal year 2003-2004 levels; support specified goals to preserve and enhance the State's natural resources, and reduce the economic impact of operating a vast transportation network. It will also help the Department to compete for additional funding available through the DEQ / State Energy Office and the Federal Government to fund energy saving programs. Energy and cost saving results to-date from current programs are summarized in the Energy and Usage Data section beginning on page 7.

Since 2003, NCDOT has implemented and tracked energy savings programs that reduce the financial burden and environmental impact of utility usage. At the conclusion of Fiscal Year 2020, DOT and NC State Port Authority (NCSPA) energy savings programs have resulted in an **energy cost avoidance of $28,338,381** and **a water cost avoidance of $13,413,637 totaling $41,752,018** over the last 16 years. By the end of FY 20, those cost savings have **reduced energy and water costs per square foot by 31% and 8% in DOT facilities respectively** as measured from the baseline fiscal year of 2003-2004. NCSPA saw a **22%** increase in energy usage, but a reduction in water consumption by **3%** per square foot during that same period. **Combined DOT and NCSPA energy and water consumption per square foot has decreased by 26% and 7% respectively since fiscal 2003-04**.

Due to the type of buildings used by NCSPA, the success of efforts to reduce energy costs in buildings is not evident by measuring energy use per square foot. A more informative metric of energy usage in NCSPA buildings is energy cost per ton of cargo transported through port terminals. In FY 20 there was a **31% increase in energy usage of per ton of cargo and a 4% increase in water usage by per ton** compared to usage during the baseline fiscal year of 2003-04.

At the conclusion of fiscal year 20, NCDOT (DOT and NCSPA) employees occupied at total of 2,382 buildings, totaling 9,376,748 square feet, with building utility costs totaling $10,771,348.

FY 20 - 22 strategies, programs, roles and deadlines are summarized in Appendix A on page 13, and energy and cost reductions achieved through FY 20 are illustrated in the following tables and graphs.

Table 1 – Total Energy Usage for DOT and NCSPA during FY 20

Agency	Building Square Fee	Total Building Utility Expense
DOT	6,552,374	$9,184,593
NCSPA	2,824,363	$1,586,755

Figure 1 – Total Avoided Utility Cost for DOT and NCSPA combined

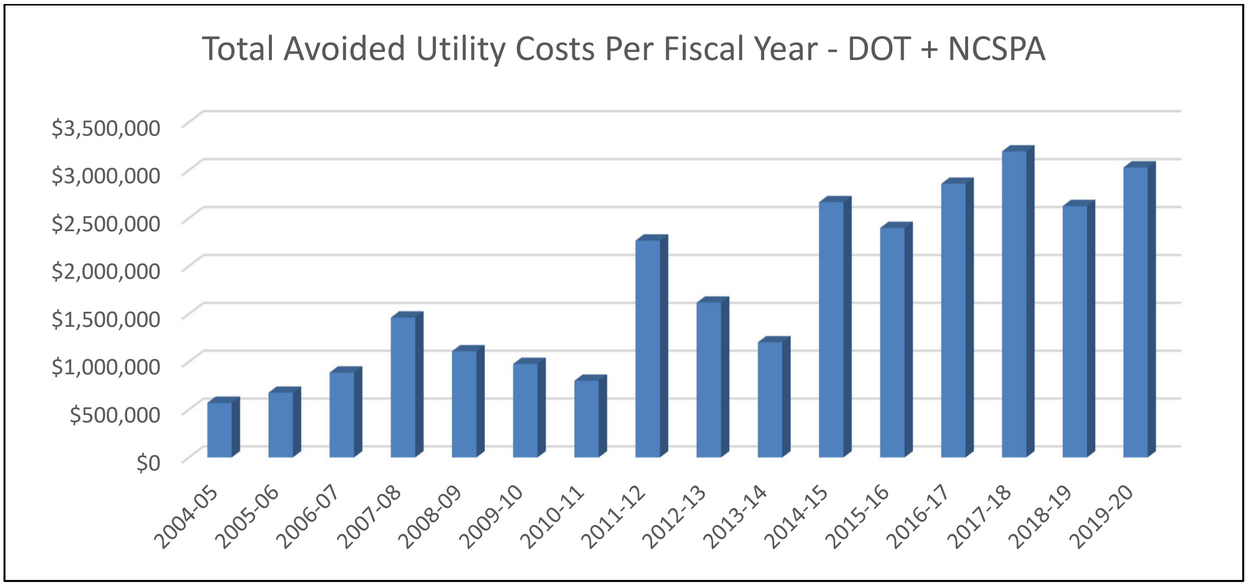


Figure 2 – % Change in Energy Usage for DOT

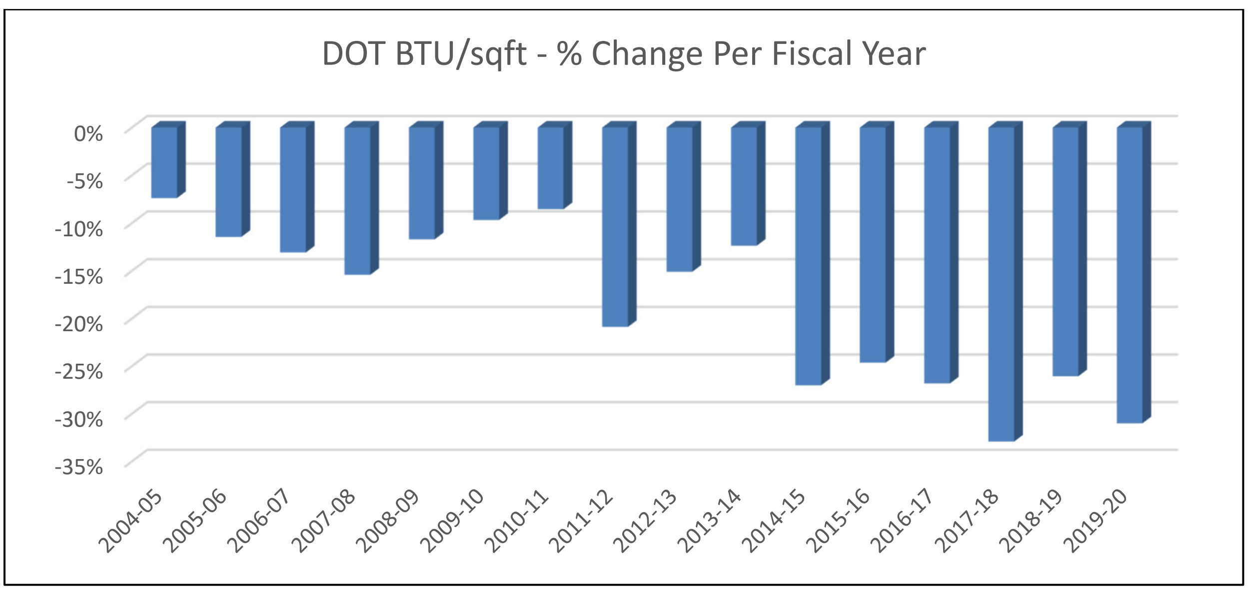


Figure 3 – % Change in Energy Usage for NCSPA

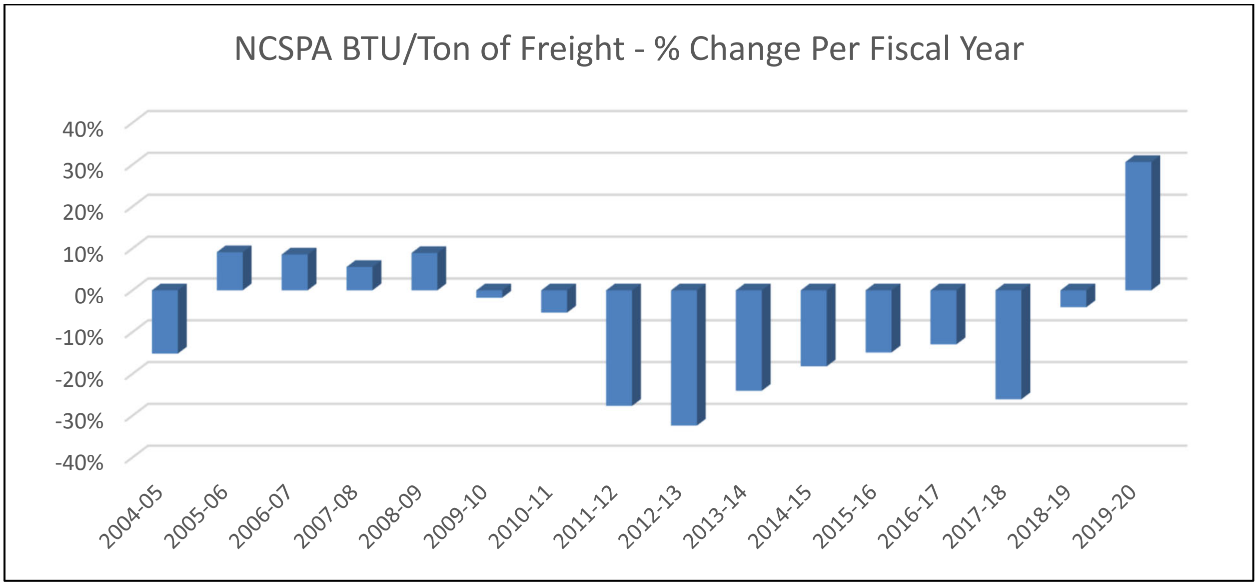
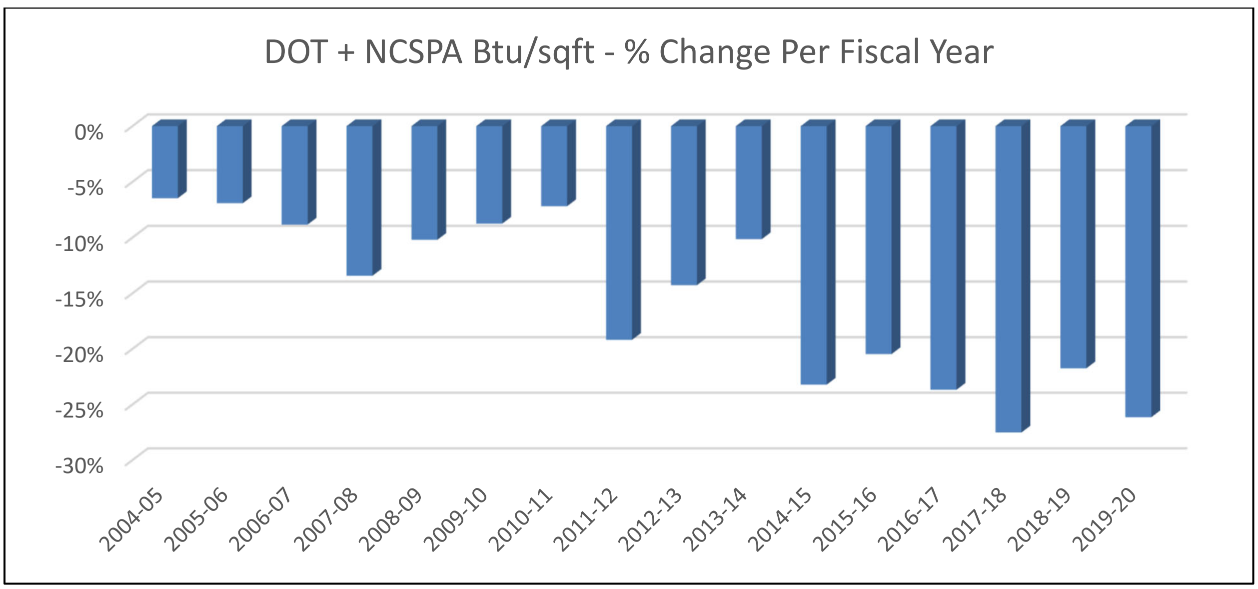


Figure 4 – % Change in Energy Usage for DOT + NCSPA



The following is a summary of the legislative and executive basis for this report, NCDOT energy reduction programs with additional data and tables illustrating results to-date.

Basis for NCDOT Agency Utility Management Plan

The Agency Utility Management Plan (AUMP) for NCDOT was developed in accordance with General Statute 143-64.10-12, *Energy Conservation in Public Facilities*, which mandates a comprehensive energy management program for State government, and Section 8 of Executive Order 80 (EO-80), NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY. This AUMP also meets the objectives of the State Utility Savings Initiative as managed by DEQ.

NCDOT Energy Conservation Programs

The primary NCDOT programs to achieve Executive Order 80 and legislative energy conservation goals are:

- Guaranteed Energy Savings Contract (GESC)
    - Use GESC as approved for state buildings or utility systems under General Statute 143-64.17, as a vehicle to fund and implement energy-related improvements.
    - *Building GESC*
        - Installed Energy Conservation Measures (ECMs) in 6 buildings in Raleigh
        - Installed more energy efficient HVAC system, lighting, windows and water fixtures.
        - Installed a building automation system to improve energy savings and monitor energy usage.
            - This system can be expanded to monitor and control HVAC systems in other DOT facilities.
        - Guaranteed cost savings over 15 years: **$8,897,860**
        - Status: Ongoing – in energy savings period
    - *Roadway Lighting GESC*
        - Upgrading roadway light fixtures on state-owned roads and in NCDOT buildings state-wide to LED-based fixtures.
        - Upgraded **10,689 roadway light fixtures** to LED-based fixtures.
        - Upgraded **14,981 interior and exterior light fixtures** in **805 DOT buildings** to LED-based fixtures.
        - Installed lighting control system to monitoring energy usage and support maintenance of fixtures.
        - Cost of installation and maintenance over 15 years to be paid from energy and operational savings.
        - Guaranteed cost savings over 15 years: **$51,295,813**
        - As of 11/11/2018 this is the only roadway lighting project in the US where project savings are used to:
            - Upgrade all state-owned roadway lighting
            - Install a lighting control system

        - Maintain & repair installed roadway lighting systems
    - Status: Ongoing -in energy savings period.

- Energy Efficiency Incentives
    - Partnering with utility providers to utilize energy efficiency incentive programs to reduce the cost of NCDOT projects - both vertical and horizontal.
    - Utilities provide a rebate for the installation of approved energy efficient hardware as well as funding approved measures / projects that will save energy.
    - Projected energy incentives from utility companies to reduce the cost of the *Roadway Lighting GESC* project by over **$1,500,000**.
    - Incentives totaling **$338,000** were received by NCDOT for the *Building GESC* project.
    - Status: Ongoing

- Analysis of Utility Accounts and Billing
    - Measuring and analyzing utility bills to identify opportunities to reduce cost and provide data in support of new and ongoing projects.
    - Investigating the use of Capturis and other utility data tracking systems as well using modified energy usage and costs reports using data from AP database.
    - As of 02/15/2020, NCDOT pays the cost of ~ 15,025 (electricity, water, gas, fuel oil, etc.) accounts.
    - Verify billing using appropriate rates.
    - Consolidate accounts to take advantage of lower rates.
    - Identifying excessive energy usage to identify and take corrective action.
    - Status: Ongoing.

- Building Energy Efficiency Design Standards
    - Ensure compliance with 2012 NC State Energy Code: Energy Conservation Code / NCGS 143-135.35, Article 8C so that new and renovated building designs are energy efficient.
    - Implement additional energy efficiency / sustainability design standards and other best practices for new and renovated buildings.
    - Status: Ongoing.

- Energy Audits
    - Perform energy audits of facilities to identify opportunities for energy and water conservation, and perform cost/benefit analysis for the proposed measures.
    - Plan and implement appropriate energy conservation projects funding permitting.
    - Status: Ongoing.

- NC Workspace Standards
    - Implementing latest State Property Office workspace standards in new and renovated buildings.
    - Reduces space / buildings needed in new and renovated buildings, energy consumption, and costs.
    - Status: Ongoing

- Training
  - Train facility managers / staff to perform preventative maintenance of existing and new systems to ensure energy and water conservation objectives are met and maintained.
  - Ensure adequate training is included in the scope of work for building projects.
  - Status: Ongoing

- Partner with Other Agencies on Energy Savings Programs
  - Work with the Department of Environment Quality (DEQ) / State Energy Office (SEO), and other agencies to participate in existing or planned energy savings programs - particularly those funded / sponsored by those agencies.
  - Energy audits paid with funding from other agencies.
    - Usually coordinated by DEQ / SEO
  - Status: Ongoing

- Education
  - Educate / inform / engage NCDOT employees regarding state-wide energy conservation project and best practices through meeting presentations, emails, Intranet web sites, etc.
  - Status: Ongoing

Energy and Utility Usage Data

The following tables and graphs list and illustrate utility usage and costs in NCDOT owned facilities from the baseline year of FY 2003-04 to-date as well as progress toward achieving energy conservation and other goals specified in EO-80 and legislation.

Figure 5 – DOT Utility Costs for FY 2019-20

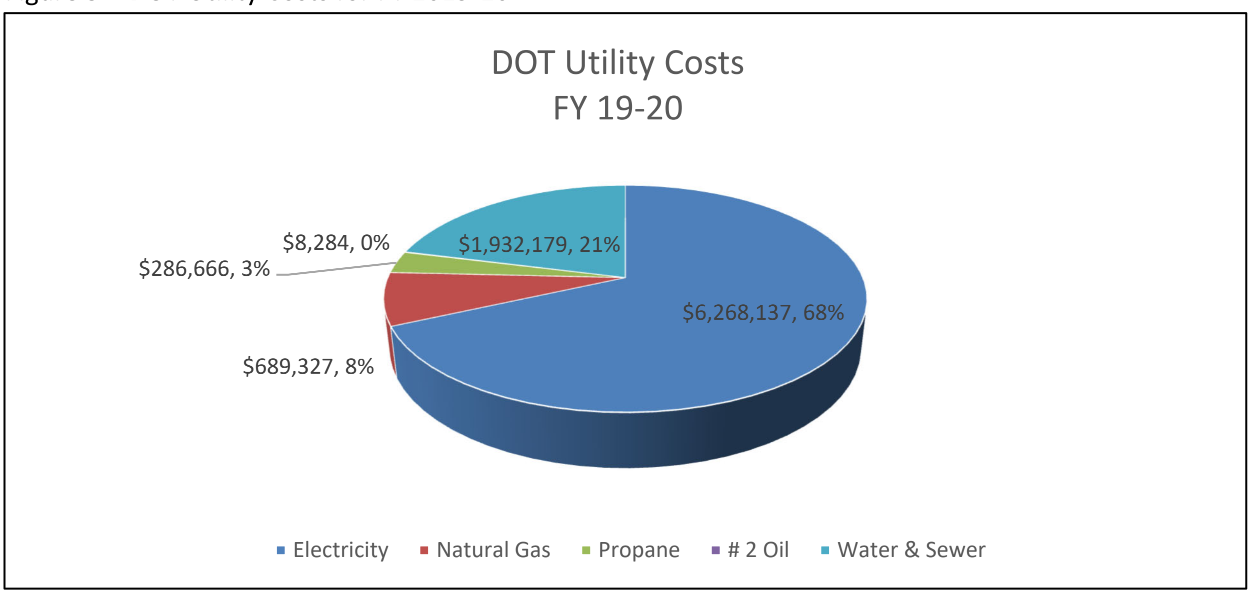


Figure 6 – DOT Total Utility Costs Per Year

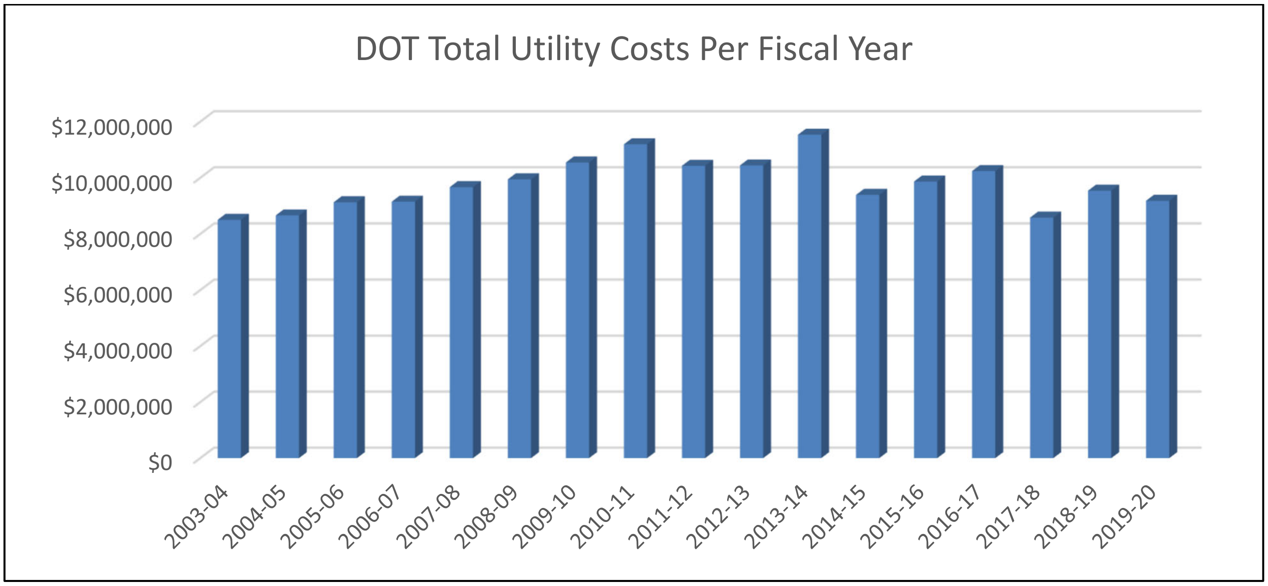


Figure 7 – NCSPA Utility Costs for FY 2019-20

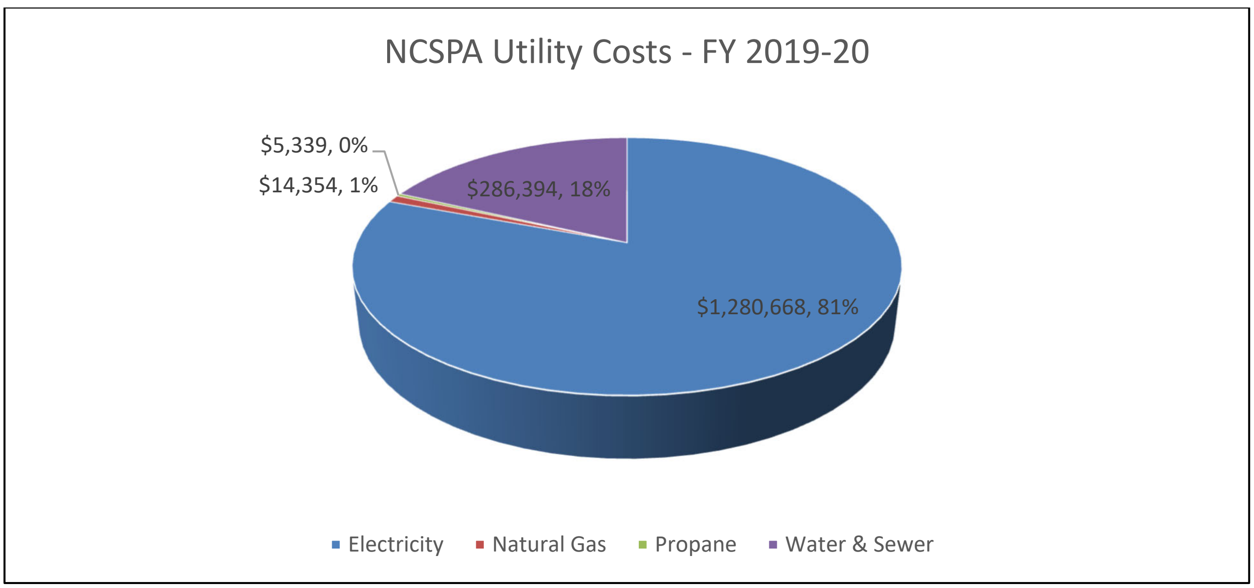


Figure 8 – NCSPA Total Utility Costs Per Fiscal Year

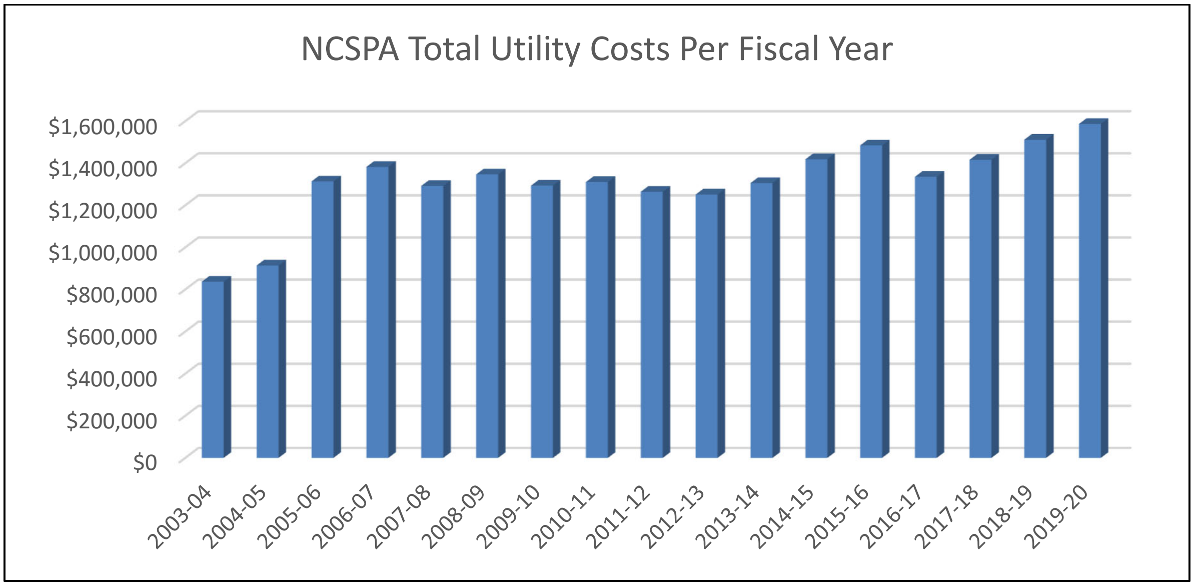


Figure 9 – DOT + NCSPA Utility Costs for FY 2019-20

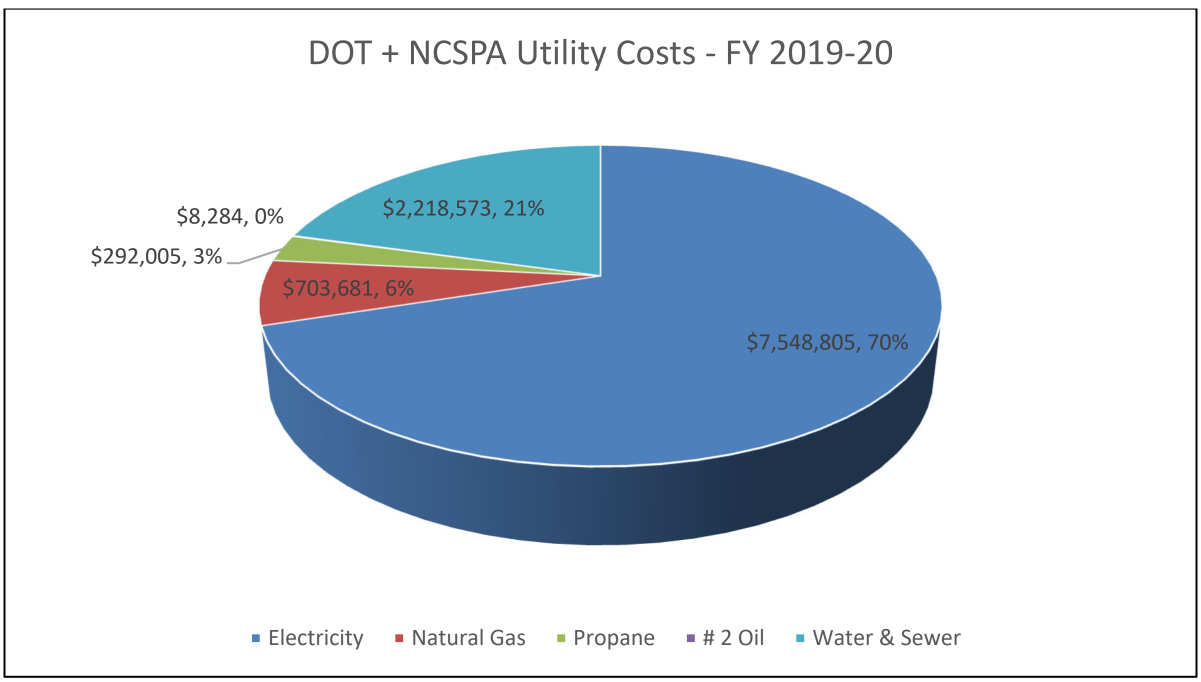


Figure 10 – DOT + NCSPA Utility Costs Per Year

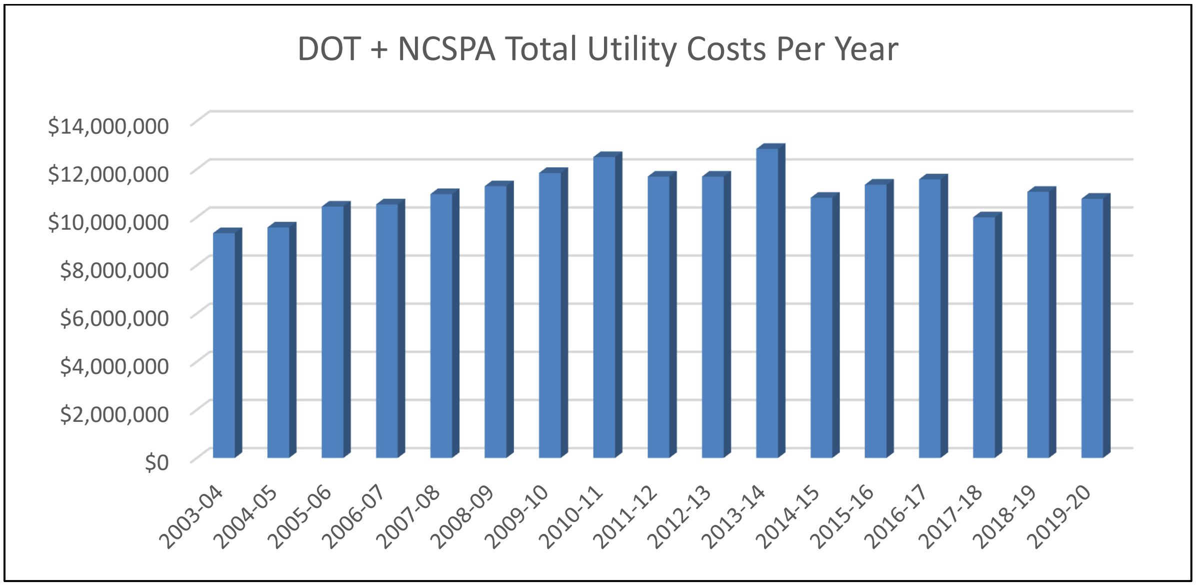


Table 2 – DOT + NCSPA Total Utility Costs and Savings Per Year

Fiscal Year	Total Utility Cost	Total Energy Cost	Total BTU	Total Savings / Cost Avoidance
2003-04	$9,341,426	$7,968,465	468,194,525,603	$0
2004-05	$9,575,686	$8,252,231	440,432,559,838	$681,870
2005-06	$10,445,101	$9,102,939	442,095,953,042	$948,020
2006-07	$10,534,967	$9,151,251	435,071,335,280	$1,289,426
2007-08	$10,962,336	$9,426,863	421,516,401,078	$1,975,965
2008-09	$11,293,419	$9,773,003	441,776,595,730	$1,567,344
2009-10	$11,841,312	$10,197,596	451,010,172,592	$1,939,150
2010-11	$12,505,316	$10,349,287	463,559,419,547	$2,572,585
2011-12	$11,693,641	$9,543,376	406,075,671,419	$4,065,367
2012-13	$11,693,575	$9,725,755	422,504,327,079	$2,139,048
2013-14	$12,842,594	$10,663,448	454,034,725,899	$1,258,751
2014-15	$10,811,735	$8,815,598	388,128,689,644	$4,470,425
2015-16	$11,354,444	$9,316,551	405,665,608,567	$3,567,365
2016-17	$11,576,783	$9,213,902	394,589,016,967	$3,227,339
2017-18	$10,000,673	$8,415,292	378,824,523,811	$4,888,300
2018-19	$11,056,122	$9,447,950	385,933,161,556	$3,027,378
2019-20	$10,771,348	$8,552,775	369,093,657,350	$3,188,775

Table 3 – DOT + NCSPA Utility Energy Usage Per Year

Fiscal Year	Elect - kWh	NG - therms	#2 oil - gals	Propane - gals	Water - kgal
2003-04	86,652,990	1,111,591	10,081	533,782	261,994
2004-05	85,256,357	885,493	12,200	561,665	242,988
2005-06	89,688,007	835,562	4,802	491,151	221,089
2006-07	89,396,867	772,125	3,275	475,535	206,793
2007-08	85,876,819	821,193	37,180	449,864	204,064
2008-09	86,587,839	907,786	58,725	517,370	211,582
2009-10	85,337,729	993,424	59,069	570,699	174,478
2010-11	89,730,765	999,185	70,528	520,451	153,404
2011-12	89,022,044	684,572	25,353	331,259	153,048
2012-13	82,430,157	970,481	25,358	443,958	218,086
2013-14	87,254,878	1,082,185	42,896	459,951	275,758
2014-15	75,191,176	842,193	31,990	468,320	148,538
2015-16	79,198,293	774,510	29,863	587,559	181,319
2016-17	76,128,423	764,352	26,747	596,787	250,203
2017-18	68,714,683	1,040,101	30,436	394,323	141,420
2018-19	75,545,860	933,992	12,389	360,656	150,182
2019-20	73,012,385	924,707	2910	295,710	260,682

Table 4 – Roadway Lighting Energy Savings Performance Contract Project - Costs and Energy Savings

Schedule N

Guaranteed Cash Flow Analysis

Total Financed Costs:	$ 33,454,594	**Escalation Rate by Utility/Fuel***	
Finance Term Years:	15	**Electric:**	0%
Annual Interest Rate:	2.75%	**Natural Gas:**	0%
Construction Months:	16	**Steam:**	
First Year Payment:	$ 2,793,285	**Water:**	0%
Principal	$ 34,596,945 including construction period interest	**Other (specify):**	
Interest	$ 7,725,119	**Escalation Rate for Annual Fees (Avg):**	2.38%

Yr.	Guaranteed Electric Dollar Savings	Guaranteed Electrical Dollar Savings from Control System	Other Guaranteed purchased Fuel Dollar Savings	Guaranteed Water Dollar Savings	-	Guaranteed Operational Dollar Savings	Total Guaranteed Dollar Savings (a)	Annual Service Fees (b)	Financing Cost (P&I) (c)	Net Savings (= a-b-c)
0	$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
1	$ 1,202,563	$ 156,718	$ -	$ -	$ -	$ 1,824,648	$ 3,183,929	$ 390,644	$ 2,793,285	$ -
2	$ 1,202,563	$ 142,297	$ -	$ -	$ -	$ 1,864,243	$ 3,209,104	$ 455,354	$ 2,753,750	$ -
3	$ 1,202,563	$ 130,047	$ -	$ -	$ -	$ 1,899,065	$ 3,231,675	$ 465,740	$ 2,765,935	$ -
4	$ 1,202,563	$ 118,913	$ -	$ -	$ -	$ 1,934,595	$ 3,256,071	$ 476,465	$ 2,779,606	$ -
5	$ 1,202,563	$ 108,492	$ -	$ -	$ -	$ 1,970,846	$ 3,281,902	$ 487,541	$ 2,794,361	$ -
6	$ 1,202,563	$ 98,576	$ -	$ -	$ -	$ 2,009,372	$ 3,310,511	$ 514,365	$ 2,796,146	$ -
7	$ 1,202,563	$ 89,043	$ -	$ -	$ -	$ 2,046,039	$ 3,337,645	$ 526,489	$ 2,811,156	$ -
8	$ 1,202,563	$ 79,815	$ -	$ -	$ -	$ 2,084,555	$ 3,366,933	$ 539,009	$ 2,827,923	$ -
9	$ 1,202,563	$ 70,837	$ -	$ -	$ -	$ 2,122,225	$ 3,395,624	$ 535,614	$ 2,860,010	$ -
10	$ 1,202,563	$ 62,068	$ -	$ -	$ -	$ 2,162,292	$ 3,426,923	$ 548,642	$ 2,878,281	$ -
11	$ 1,202,563	$ 53,481	$ -	$ -	$ -	$ 2,210,637	$ 3,466,680	$ 636,702	$ 2,829,978	$ -
12	$ 1,202,563	$ 45,051	$ -	$ -	$ -	$ 2,250,095	$ 3,497,709	$ 652,104	$ 2,845,605	$ -
13	$ 1,202,563	$ 36,760	$ -	$ -	$ -	$ 2,292,095	$ 3,531,418	$ 685,670	$ 2,845,748	$ -
14	$ 1,202,563	$ 28,596	$ -	$ -	$ -	$ 2,333,153	$ 3,564,312	$ 702,431	$ 2,861,881	$ -
15	$ 1,202,563	$ 20,545	$ -	$ -	$ -	$ 2,375,019	$ 3,598,127	$ 719,728	$ 2,878,399	$ -
Total	**$ 18,038,442**	**$ 1,241,240**	**$ -**	**$ -**	**$ -**	**$ 31,378,878**	**$ 50,658,561**	**$ 8,336,497**	**$ 42,322,064**	**$ -**

NOTES:
1) Annual Net Savings must never be negative.
2) A surplus in one year cannot be carried forward to create positive cash flow in a subsequent year.
3) "Annual Service Fees (b)" includes Owner 3rd party review fee of + ESCO M&V + Service fees
4) Guaranteed savings values will be verified per calculation methods in Schedule F.
5) Interest rate as provided by ISSUER to ESCO. Payments are calculated monthly in arrears.
6) Electric and Operating savings will all be combinned and guaranteed annually as a total savings amount and not individually.
7) Construction Period Interest is capitalized for calculation of Financing Costs (P&I)

Table 5 – Building Energy Savings Performance Contract – Costs and Energy Savings

Yr.	Guaranteed Electric Dollar Savings	Guaranteed Natural Gas Dollar Savings	Guaranteed DOA Steam and Chilled Water Dollar Savings	Guaranteed Water Dollar Savings	Other Please Specify	Guaranteed Operational Dollar Savings	Guaranteed Dollar Savings (a)	Annual Service Fees (b)	**Financing Cost (P&L) (c)	**Net Savings = a-b-c
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$162,321	$ 598,169	$ 27,760	$ 570,408	$ 1
2	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$161,670	$ 597,518	$ 28,315	$ 569,200	$ 3
3	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$161,005	$ 596,854	$ 28,882	$ 567,972	$ 0
4	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$160,328	$ 596,176	$ 29,459	$ 566,716	$ 1
5	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$159,637	$ 595,485	$ 30,048	$ 565,436	$ 1
6	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$158,932	$ 594,780	$ 30,649	$ 564,128	$ 3
7	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$158,213	$ 594,061	$ 31,262	$ 562,796	$ 3
8	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$157,479	$ 593,328	$ 31,888	$ 561,440	$ 0
9	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$156,731	$ 592,580	$ 32,525	$ 560,052	$ 2
10	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$155,968	$ 591,817	$ 33,176	$ 558,640	$ 1
11	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$155,190	$ 591,038	$ 33,839	$ 557,196	$ 3
12	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$154,396	$ 590,244	$ 34,516	$ 555,728	$ 0
13	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$153,586	$ 589,435	$ 35,206	$ 554,228	$ 0
14	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$152,760	$ 588,609	$ 35,911	$ 552,696	$ 2
15	$ 308,979	$ (48,616)	$ 175,485	$ -	$ -	$151,918	$ 587,766	$ 36,629	$ 524,581	$ 26,556
Total	$ 4,634,691	$ (729,240)	$ 2,632,275	$ -	$ -	$ 2,360,134	$ 8,897,860	$ 480,065	$ 8,391,217	$ 26,578

Appendix A

NCDOT Agency Utility Management Plan

2019-21

Focus Area 1: Comprehensive Plan	
Strategy 1.	Designate Energy Manager as the point of contact for SEO
Strategy 2.	Edit or create a plan to reflect energy efficiency strategy toward 40% reduction in Btu/gsf and EO-80 goals.
Strategy 3.	Contact the SEO to assist with review of strategy, budget, training, and timeline.
Strategy 4.	Develop internal stakeholders to develop behavioral programming and internal team building toward goals
Strategy 5.	Implement Plan

2019-2021 Planned Activities	Expected Measurement	Assigned To	Occurrence
Meet with SEO to develop ideas for plan	Discuss training schedule available, current Utility Management Plan and future Management Plan	Energy Manager and SEO staff	Quarterly
Research facilities for potential energy savings projects	Create a list to use for potential projects to be implemented in the Utility Management Plan	Energy Manager and Agency Staff	Quarterly
Create a Utility Management Plan	Complete timeline and approvals from agency and submit plan to SEO	Energy Manager, Agency Staff, and NCDOT Climate Change Workgroup	Due March 1, 2019, thereafter October 1st each year
Attend SEO or other energy conservation training sessions	Discuss lessons learned with staff and how that can enhance your strategy	Agency staff	As available
Develop internal stakeholders and internal teams to implement plan	Designate a person or team to implement portions on the plan	Energy Manager, Agency staff, and NCDOT Climate Change Workgroup	May, 2019

2019-2021 Planned Activities	Expected Measurement	Assigned To	Occurrence
Develop internal marketing and awards/rewards program	Designate person to develop programming and implement program	Energy Manager, Agency Staff, and NCDOT Climate Change Workgroup	May, 2019
Review Utility Management Plan progress	Tweak plan if it is not realizing expected savings	Energy Manager, and NCDOT Climate Change Workgroup	Quarterly
Track and analyze utility data	Record monthly utility data for annual utility report to submit to SEO and trend to catch anomalies early on	Energy Manager	Monthly, September 1st each year
Performance Contracts	Verifying guaranteed energy savings are achieved, and execute contractual requirements	Energy Manager and Agency Staff	Monthly monitoring and annual energy savings verification.
Energy Efficiency Incentives	Partner with utility providers to utilize energy efficiency incentive programs to reduce the cost of NCDOT projects - both vertical and horizontal.	Energy Manager and Agency Staff	Evaluate by project.
Building Energy Efficiency Design and Workspace Standards	Implement most recent NC State Energy Code and additional energy efficiency / sustainability design standards, SPO workspace standards, and other best practices for new and renovated buildings.	Energy Manager and Agency Staff	Update quarterly.
Partner with DEQ / State Energy Office and other agencies on energy savings projects	Coordinated with DEQ and other agencies.	Energy Manager and Agency Staff	As available
Training	To promote preventative maintenance of new and existing systems to maintain expected energy savings.	Energy Manager and Agency Staff	As contractually required.
Education	To inform and promote energy savings	Energy Manager and Agency Staff	TBD

2019-2021

Focus Area 2: Projects to Implement	
Strategy 1.	Review projects with staff to determine high priority projects to implement
Strategy 2.	Work with staff to determine the best timeframe to implement projects
Strategy 3.	Create a schedule for projects to be implement during the fiscal year
Strategy 4.	Communicate projects to staff
Strategy 5.	Implement projects

Planned Activities	Expected Measurement	Assigned To	Occurrence
Building Energy Performance Contract	Annual energy savings	Energy Manager and Agency Staff	Ongoing
Roadway Lighting Energy Performance Contract	Completion of construction work by 3/31, annual energy savings, and compliance with contractual maintenance requirements.	Energy Manager and Agency Staff	Ongoing
Energy Efficiency Incentives	Funds received per project	Energy Manager and Agency Staff	Ongoing
Analyze and track uility accounts to reduce costs and identify problems to correct	Funds saved	Energy Manage and Agency Staff	Ongoing
Investigate options for tracking utility data	Determine the best method to track utility data	Energy Manager and Agency Staff	Ongoing
Energy Audits and Corrective Measures	Identification of buildings that show excessive energy usage; determine cause and implement corrective actions.	Energy Manager, DEQ, and Agency Staff	TBD
Building energy efficiency design and SPO workplace standard	Update annually	Energy Manager and Agency Staff	Annually
Develop priority list of projects for 2020-21	Develop list of projects and start to schedule implementation for next fiscal year	Energy Manager and staff	June 30, 2020

NC Department of Transportation

Agency Utility Management Plan Declaration

- The NC Department of Transportation recognizes that energy and water consumption can be managed for the benefit of our agency. Energy and Water management is the responsibility of the staff at each facility, guided and supported by the NCDOT Energy Management Engineer.
- The Department of Transportation has implemented an Agency Utility Management Plan for NCDOT-owned facilities. The Director of Facilities Management Division is responsible for the success of the program in NCDOT facilities.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption in NCDOT-owned facilities to achieve the goals of the program.
- The Department Secretary's staff will review progress and results, and will support staff attendance at training in energy and water management.

Agency Utility Management Plan Goals

As required in Executive Order 80, NCDOT will support efforts to reduce by 2025 total energy consumption per square foot in state owned buildings by at least 40% below fiscal year 2002-2003 levels, and implement energy efficiency best practices and programs in support of these goals.

Agency Utility Management Plan – Measures

Our tracking measures will be the following Key Performance Indicators:

Total Energy Use per Square Foot
Total Energy Cost per Square Foot
Total Water Use per Square Foot
Total Water Cost per Square Foot

Strategic Energy and Water Plan Mandate – Commitment

I have read the Agency Utility Management Plan for the NC Department of Transportation. The plan, as presented, supports the reduction required in Executive Order 80.

Updated this 1 st day of March 2021.

DocuSigned by:
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Eric R. Frazier
Energy Management Engineer

Director, Facilities Management Division

Department Secretary

STRATEGIC ENERGY MANAGEMENT PLAN

for

NC DEPARTMENT OF AGRICULTURE

&

CONSUMER SERVICES

September 2021

Prepared By:

Property & Construction Division

1001 Mail Service Center

Raleigh, NC 27699-1001

EXECUTIVE SUMMARY Current Status

The North Carolina Department of Agriculture & Consumer Services (NCDA&CS) has been using an excel spreadsheet to track utility usage since 2002. In 2011, the NC Forest Service and Soil & Water Divisions were transferred from what was at that time the NC Department of Environment and Natural Resources (NCDENR) to NCDA&CS. Energy utilization for these divisions was incorporated into the existing data maintained by NCDA&CS. Because the information from the prior periods was not available for the additional buildings, a new benchmark for data tracking and energy usage was created.

NCDA&CS manages 206 locations across the state with a total of approximately 1200 state owned buildings with a total gross square footage of 3,840,010. The range in size of the facilities vary from 1 office building to a 400-acre research station with 87 buildings or 33,000-acre state forest with 40 buildings to the NC State Fairgrounds with previously (before COVID 19) 500 events year round. Seventy-two percent (72%) of the buildings are less than 2,500 square feet and used as a field office for 1 – 4 employees or for storage. NCDA & CS has buildings whether State Owned or leased in 99 counties across NC Statewide. The diversity of sites from size, use, number and type of building, present a challenge in monitoring utilities and identifying energy savings initiatives.

Prior to November of 2016, NCDA&CS utilities were submitted directly to Accounts Payable for payment. Invoices were scanned and sent to Divisions for review. Either throughout the year or annually when requested, Divisions would gather energy usage and cost information to be submitted for the Annual Energy Report. This system provided inconsistencies in the reporting because data collection was completed at the site level. In November of 2016, NCDA&CS transitioned to a 3rd party service for utility data collection. The first full year of data collection was 2017-18 and after reviewing the report for 2018-2019, data from the energy evaluation was a significant decrease from the prior years. In 2019-2020 there was also a decrease in energy consumption; however, with COVID19 and less people in the workplace, this is an extremely difficult year to assess.

NCDA&CS will continue to work to develop and implement efforts to improve energy and water conservation at all locations. The initial step being to create, implement and follow an effective Strategic Energy/Water Conservation Plan. The objective of the Strategic Energy/ Water Conservation Plan is to foster economically and environmentally responsible usage of valuable resources in accordance with State legislation.

FOCUS AREAS Focus #1 – Data Management 2017 – 18 Planned Activities

Overview: In November of 2016, NCDA&CS transitioned to a 3rd party utility billing system. The new system will provide consistency in collection and reporting of key elements from each

invoice. Accounting Staff will monitor the system for expenditures, changes in service and late fees.
Responsible Groups: Accounting Clerk
Funding Source: General Operations and Salary
Metric: Notification of late fees, recording of necessary data; fewer disruptions in service

2017-18 Planned Activities
Overview: Using the 3rd party utility billing system identify a revised baseline and benchmark for assessing energy and water usage by Division down to site level.
Responsible Groups: Division staff – positions to be determined
Funding Source: Salaries
Metrics: Benchmarks established for each Division

Future Planned Activities

- Identify baseline data and benchmarks for each location with an emphasis on large energy consumers such as labs, greenhouses and animal facilities

Focus #2 – Facility Management

2016-17 Past Activity
Overview: Upgrading of lighting at NCDA&CS facilities through Duke Energy Incentives. Initiate upgrades at the Farmers Markets & Agriculture Event Centers
Responsible Groups: Property & Construction Division staff & site managers **Funding Source:** General Appropriations & Receipts
Metric: Reduction in energy usage tracked through Capturis.

2017-18 Past Activities
Overview: In 2016, NCDA&CS initiated a project to identify all state-owned buildings. The project has been useful in verify building existence, utilization, and square footage. The project is scheduled to be completed no later than June 30, 2018. **Responsible Groups:** Property & Construction Division staff **Funding Source:** General Appropriations and Salaries **Metric:** Accurate & Up-to-date building inventory.
Focus #2 – Facility Management

2017-18 Past Activities
Overview: Assessment of energy and water usage for each NCDA&CS managed site using the reports and graphs from the 3rd party billing system.

Responsible Group: Site Managers **Funding Source:** Salaries
Metric: List of energy savings projected by site

Future Planned Activities

- Identify low or no cost initiatives
- Evaluate energy savings from lighting upgrade project at Farmer's Markets and Ag Center, evaluate other sites for lighting upgrades
- Identify unused and underutilized buildings; disconnect utilities and demolish
- Design new buildings to be energy efficient, utilizing green technology if applicable

Focus #3 – Organizational Communication and Outreach

2017-18 Past Activities
Overview: Notify all site managers and administrative staff of the 3rd party utility billing system; provide access information; identify training opportunities
Responsible Groups: Accounts Payable staff
Funding Source: General Appropriations and Salaries
Metric: Site staff accessing the system and running reports to track energy and water usage

Focus for Future Planned Activities 2019-2021

- Identify training modules for all NCDA&CS staff to be assigned through LMS to aid in identification of no cost and low cost savings opportunities.
- Pilot program through State Property Fire Insurance to allow sensors on equipment such as Hot Water Heaters, Pipes and condenser Units to notify staff about freezing pipes or differential temperatures.
- Demolition and severance of multiple hazardous Buildings to eliminate current utility bills.
- Roof replacement and repairs on approximately 53 Buildings throughout NCDA & CS sites to minimize excessive energy consumption.
- The Completion of the NCDA & CS new Agricultural Science Center Lab in Raleigh which will house 5 existing Laboratories into 1 shared building complex. Estimated completion time to be end of October 2020. This will be more cost effective and energy efficient because the currently used aged buildings do not have upgraded mechanical/electrical/ components that aren't using today's standards in construction.

Past Activities & updates for 2020-2021:

Overview: In March 2021, the COVID 19 pandemic hit the Country, most employees worked remotely throughout the year which has contributed to a reduction in savings and energy consumption. At this time many of the employees are still working remotely throughout the Department across the State. The Governor placed an Executive order on the State, therefore reducing many work and in person activities to be put on hold. During this time NCDA & CS's IT team implemented the Team's software which allowed many employees to have virtual meetings which conserved gas, utilities, and travel time.

- July 2021- June 30th-2021 there have been approximately 15 new roofs replaced
- July 2021- June 30th 2021 there have been approximately 10 Buildings that have been demolished and many more planned in the future.
- The New Steve Troxler Agriculture Science Center is completed with a projected move in date beginning the end of July 2021 (in process)

The new Agriculture Science Center will accommodate approximately 200 employees in one large facility consisting of 223,000 sq. ft. The move will combine many offices into cubicles, therefore eliminating the use of many buildings and even rented space. We will surplus 2 NCDA Buildings (at this time) consisting of over 70,000 q. ft.

Some Features of the new Agriculture Science Facility

- Ultraviolet Lighting
- Bipolar Ionization
- R-19 Insulation in Walls
- R-56 Roofing (the expected was R-30 resulting in more savings

Future Plans of 2021-2022

The NCDA & CS expects to have approximately 5 new buildings across the state varying from Pole Shelters, Barns, Offices and Equipment Maintenance Shops. We will be replacing 3 buildings caused by fire. The new buildings will be more energy efficient (most) and consist of updated building and manufacturing upgrades as most of NCDA's building were built prior to 1970.

Strategic Energy Plan
North Carolina Justice Academy
Salemburg, NC

Summary

The North Carolina Justice Academy, in Salemburg, provides training to law enforcement personnel. We currently have over 200,000 square feet of facilities that offer housing, classrooms, and support facilities for this training. We will continue to focus on five key areas, in addition to staff awareness.

- *Energy Data Management*- NCJA has developed a system that records and analyzes monthly usages. This information is useful to identify potential problems and to locate where savings can be found.

- *Rate Management*- NCJA works with Duke Progress Energy and Energy Professionals to ensure we are at best possible rate. The NCJA will also follow suggestions and guidelines established by the State of North Carolina. We invite assistance from the State Energy Office to review our rates.

- *Building Energy Usages*- Each building is unique, and opportunities for savings may differ from building to building. We have seen reductions in buildings that have recently been renovated in specific areas. The NCJA received appropriations to renovate two (2) residence halls. Residence Hall C started in late 2019 and B will begin early 2021. We anticipate significant energy savings after completion of both.

- *Efficient Equipment*- When the opportunity presents itself, we replace equipment with high efficiency or low-consumption equipment. We use automated HVAC controls in 7 buildings, and all new construction or renovation will include controls to improve efficiency. As mentioned above, we will install new efficient equipment and systems as part of our upcoming renovations.

- *Staff Awareness*- The Academy will provide information to all staff, urging their cooperation for energy savings.

Baseline

We are using data from past fiscal years to showing savings and trends

Year	Water	Sewage	Gas	Electric
2001-02	$4,491	$7,327	$44,588	$181,224
2002-03	$4,305	$7,214	$68,905	$189,409
2003-04	$4,650	$8,031	$89,178	$196,854
2004-05	$5,110	$10,433	$88,948	$192,367
2005-06	$5,122	$10,979	$92,078	$196,257
2006-07	$8,216	$9,823	$73,516	$205,188
2007-08	$7,865	$10,783	$68,746	$225,232
2008-09	$6,847	$10,179	$70,976	$227,611
2009-10	$7,330	$12,612	$77,237	$255,373
2010-11	$7,146	$12,687	$65,562	$261,630
2011-12	$7,704	$14,219	$45,489	$254,882
2012-13	$7,743	$13,570	$49,965	$250,678
2013-14	$8,148	$13,295	$47,614	$253,044
2014-15	$9,145	$14,700	$45,737	$265,284
2015-16	$9,328	$16,570	$45,723	$274,607
2016-17	$11,989	$16,490	$49,215	$245,883
2017-18	$10,440	$16,409	$55,341	$247,745
2018-19	$10,108	$14,962	$46,409	$262,115
2019-20	**$9,909**	**$12,972**	**$39,079**	**$232,824**

- *Cost per square foot*

Year	Square Footage	Utility Cost	Average per Sq. Ft.
2001-02	204,206	$237,630	$1.16
2002-03	204,206	$269,833	$1.32
2003-04	204,206	$298,713	$1.46
2004-05	204,206	$296,858	$1.45
2005-06	204,206	$304,426	$1.49
2006-07	204,206	$296,743	$1.45
2007-08	204,206	$312,626	$1.53
2008-09	204,206	$315,613	$1.55
2009-10	204,206	$352,552	$1.73

2010-11	204,206	$347,025	$1.70
2011-12	204,206	$322,294	$1.58
2012-13	204,206	$321,956	$1.58
2013-14	204,206	$322,101	$1.58
2014-15	204,206	$334,866	$1.64
2015-16	204,206	$346,228	$1.70
2016-17	204,206	$323,577	$1.58
2017-18	204,206	$329,935	$1.62
2018-19	204,206	$333,594	$1.63
2019-20	**204,206**	**$294,784**	**$1.44**

- *Cost per night spent on campus*

Year	Nights Spent	Utility Cost	Average per Night
2001-02	32,601	$237,630	$7.30
2002-03	33,365	$269,833	$8.09
2003-04	39,912	$298,713	$7.48
2004-05	39,971	$296,858	$7.43
2005-06	31,622	$304,426	$9.63
2006-07	26,675	$296,743	$11.12
2007-08	27,899	$312,626	$11.21
2008-09	24,748	$315,613	$12.75
2009-10	31,815	$352,552	$11.08
2010-11	32,873	$347,025	$10.56
2011-12	33,688	$322,294	$9.57
2012-13	35,506	$321,956	$9.07
2013-14	36,226	$322,101	$8.89
2014-15	36,226	$334,866	$9.24
2015-16	44,991	$346,228	$7.70
2016-17	43,597	$323,577	$7.42
2017-18	39,223	$329,935	$8.42
2018-19	30,702	$333,594	$10.87
2019-20	**15,024**	**$294,784**	**$19.62**

- *Consumption of Utilities*

Year	Gallons of Water	Therms	KWH
2001-02	3,130,000	56,500	2,494,377
2002-03	3,107,000	81,395	2,632,712
2003-04	3,512,000	83,432	2,774,597
2004-05	3,452,000	73,088	2,545,930
2005-06	3,589,000	60,928	2,186,008
2006-07	3,033,000	56,999	2,475,527
2007-08	2,826,000	49,877	2,591,612
2008-09	2,228,000	53,896	2,461,583
2009-10	2,492,000	66,635	2,831,877
2010-11	2,223,000	67,550	3,035,041
2011-12	2,538,000	50,792	2,920,931
2012-13	2,110,000	56,735	2,820,249
2013-14	2,059,000	52,204	2,788,825
2014-15	2,567,000	57,390	2,924,905
2015-16	2,570,000	59,262	3,039,455
2016-17	3,269,000	53,948	2,739,709
2017-18	3,192,000	50,689	2,705,972
2018-19	2,118,000	50,231	2,645,405
2019-20	**1,818,000**	**48,471**	**2,366,941**

Results: *The NCJA suspended in-person training on March 16, 2020, until the end of the fiscal year.*

As a result of renovations and the suspension of in-person training due to Covid-19, our overall consumption has been impacted. We are pleased to see the reduction in costs of $38,810; however, it is a result of the cancelation of in-person training.

Conclusion:

The NCJA East Campus is committed to identifying and implementing energy-saving measures. In the fall of 2019, the NCJA started a significant renovation of Residence Hall C. We plan to begin a renovation of Residence Hall B in 2021. As part of both renovations, the NCJA is installing higher efficiency equipment throughout the buildings. We will continue to explore energy savings opportunities and welcome suggestions from the State Energy Office.

Strategic Energy Plan
North Carolina Wildlife Resources Commission
2020-2021

Executive Summary:

North Carolina Wildlife Resources Commission is dedicated to reducing its impact on the environment. The agency's missions include habitat conservation, watershed enhancement, and non-game and endangered species protection. The agency is dedicated to lowering its carbon footprint and thus its total energy and water consumption. The purpose of this Strategic Energy Plan is to make the staff aware the energy is a controllable expense and to reduce the total amount of energy consumed by NCWRC.

Key elements of the plan include:

- Educating and engaging faculty, staff, and students in energy and water conservation through presentations, emails, handouts, and other effective forms of communication that help the understanding that effective energy conservation supports the primary mission of The CC by using less funding for operating expenses which may provide more funds for curriculum purposes.
- Accurate measurement and analysis of electricity, fossil-based fuels, and water usage, including a quarterly review of trends and costs.
- Conducting energy audits to identify opportunities for conservation. Developing cost/benefit estimates for opportunities and appropriately prioritizing projects based on probable benefit and available resources.
- Executing approved physical plant equipment projects, process improvements, and vehicle purchases that reduce the net consumption of fossil based fuels and increase the creation and use of sustainable energy sources.
- Annual review of utility Billing Rates with suppliers.
- Applying sustainable building practices in all major facility construction/renovation projects, and in operating and maintenance of buildings in accordance with US Green Building Council / LEED standards to the highest level practical.

1. North Carolina Legislative basis for the Plan:

a. *Session Law 2007-546 / Senate Bill 668* - Energy Consumption per gross square foot to be reduced by 20% by 2010 and 30% by 2015 based on the 2003-2004 fiscal year. Each State Agency to update its management plan annually and include strategies for supporting consumption reduction requirements. Each State Agency shall submit to the State Energy Office an annual written report of utility consumption and costs.

b. *Session Law 2008-203 / Senate Bill 1946* - Energy Efficiency Improvement: 30% for major construction projects, 20% for major renovation projects based on 2004 codes. Water Use: for major construction or renovation projects 20% less indoor potable water use, and sum of outdoor potable water use and harvested storm water use at least 50% less based on 2006 NC Building Code.

2. Organizational Support for Energy Culture Change

- Attempt to educate people of the public as well as state employees within Wildlife about the energy efficient designs and features within the Wildlife Headquarters building in Raleigh.
- Attempt to educate managerial staff on the benefits of using LED & CFL lamps, programmable thermostats, and occupancy sensors.
- Continue the process of having employees who code utility invoices keeping electronic files of energy consumption and bill amount

Past 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Tours of Green Building for students, public, and state employees	3	2	n/a	n/a	Salary		Jeff Cole	O&M
Educate hatchery and depot managers about the benefits of LEDs, programmable thermostats, and solar panels.	2	2	n/a	n/a	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Tours of Green Building for Students, Public, and State Employees	3		n/a		Salary		Jeff Cole	O&M
Educate hatchery and depot managers about the benefits of LEDs, programmable thermostats and solar panels.	2		n/a		Salary		Jeff Cole	O&M

3. Supply Side

- Review Energy rates with service providers
- Note and investigate changing trends

Past 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Reviewed Energy Rates with other Electric Companies	5	5	n/a	n/a	Salary		Jeff Cole	O&M
Review Rates with water providers	4	4	n/a	n/a	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Review Rates with other Electric Companies	5		n/a		Salary		Jeff Cole	O&M
Review Rates with water providers	4		n/a		Salary		Jeff Cole	O&M

Demand Side

- Take part in surveying depots, hatcheries, and education centers for potential energy savings opportunities.
- Initiate project to refit different wildlife sites with occupancy sensors, compact florescent bulbs, and programmable thermostats.

Past 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Upgrade HVAC software controls package at HQ Building	1	1	15%	TBD	Salary		Jeff Cole	O&M
Replace HVAC units at Pisgah Education Center	1	1	15%	TBD	Salary		Jeff Cole	O&M

Next 12 months Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Jobs	Assigned to	Funding Source
Replace Boiler system at HQ Building	2		TBD		Salary		Jeff Cole	O&M

I have read the Strategic Energy and Water Plan for my Organization. The plan, as presented, supports the reductions required in Senate Bill 668.

Implemented this _3rd__ day of _September 2020.

Facilities Mechanical Engineer
Jeff Cole

Engineering Section Chief
Gary Gardner

Appalachian
STATE UNIVERSITY

2021 – 2022 Strategic Energy and Water Management Plan

September 2021

Table of Contents

Executive Summary

Appalachian State University has a long-standing commitment to sustainability. Various university commitments and state mandated benchmarks all drive towards one overarching goal, climate neutrality.

For the purpose of this Strategic Energy and Water Management Plan (SEP), climate neutrality is defined in relation to the university's campus energy and water consumption. Appalachian State University's Office of Sustainability has a broader focus that encompasses additional considerations such as the impacts of food consumption, material sourcing, commuting, etc. This SEP is written with the long-term goal of eliminating energy and water-related greenhouse gas emissions by 2050. This target year is set as the latest possible timeline and used as a way of measuring progress. Actual energy and water reductions are intended to be made as aggressively as possible.

Strategic Planning

A data driven analysis of the university's energy and water consumption will provide an opportunity to evaluate progress, identify issues, and prioritize opportunities that can help the university reach its climate neutrality goals. Establishing specific, measurable, and realistic goals allows for the development an informed strategy. The SEP evaluates three target areas for the fiscal year (FY) from July 2021 through June 2022:

1. Greenhouse Gas Emissions
2. Energy and Water Use
3. Energy and Water Expense

Year in Review

While there was a slight increase in overall energy use, it's important to remember that both FY 19/20 and FY 20/21 were directly impacted by the COVID-19 pandemic. Factors to keep in mind:

1. To the extent possible, HVAC systems were operated with increased amounts of outside air (instead of already conditioned return air) which made operating buildings more energy intensive, especially during winter months.
2. The vast majority of classes were online so even though university buildings were open, classroom and office occupants were limited so electrical reductions from a lack of use of lighting, computers, and other electronics are likely temporary.

Figure 1 outlines campus energy and water consumption for the last two years. FY 18/19 is also included as it represents the most recent year with a fully occupied campus.

Figure1. Yearly Campus-Wide Consumption Figures

	2018/19 Totals	2019/20 Totals	2020/21 Totals
Facility Greenhouse Gas Emissions	42,036 MT eCO_2	37,833 MT eCO_2	37,942 MT eCO_2
Vehicle Greenhouse Emissions	889 MT eCO_2	749 MT eCO_2	666 MT eCO_2
Energy Use Intensity	93.9 kBTU / sq.ft	85.4 kBTU / sq.ft.	81.9 kBTU / sq.ft.
Water Use Intensity	17.1 gal / sq.ft.	12.9 gal / sq.ft.	11.4 gal / sq.ft.
University Energy Expense	$6.8 million	$5.66 million	$5.86 million
Water and Sewer Expense	$1.2 million	$1.1 million	$1 million

Moving Forward

As Appalachian State University prepares to return to pre-pandemic operations, the biggest challenge will be maintaining these reductions achieved over the past two years. With a fully occupied campus, energy usage is likely to increase. The university must ensure occupant safety while also making progress towards its long-term energy and water goals. The following goals represent a best-case scenario for the next fiscal year. With so many unknowns surrounding the future of the COVID-19 pandemic, these goals may require modification.

Figure 2. FY 21/22 Energy and Water Goals

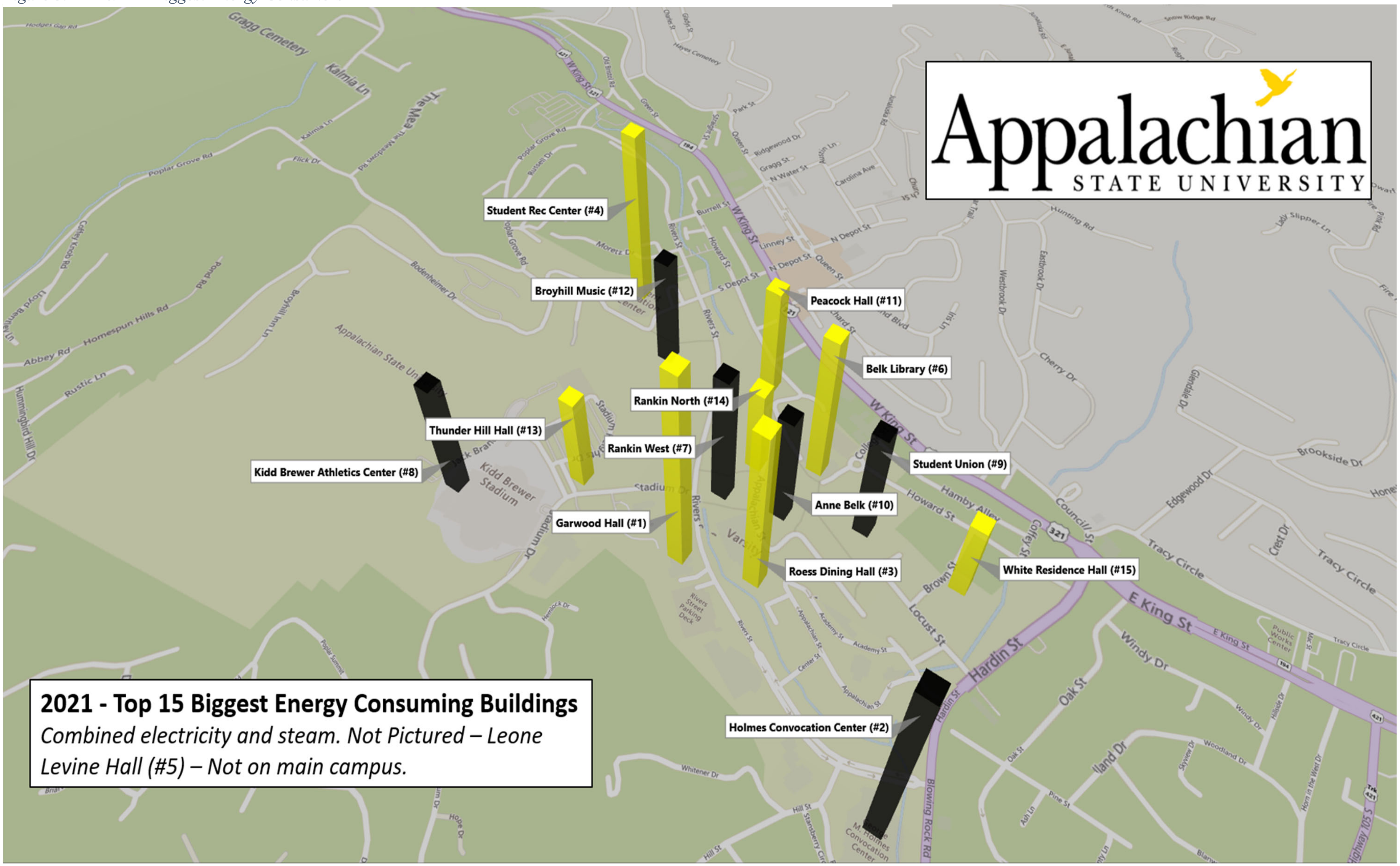
2021/22 Energy and Water Goals	Reduction Goal
Reduce Facility Greenhouse Gas Emissions	8% reduction (from FY 20/21) to 34,905 MT eCO_2
Reduce Vehicle Greenhouse Gas Emissions	10% reduction (from FY 18/19) to 800 MT eCO_2
Reduce Energy Use Intensity	1% reduction (from FY 20/21) to 81.1 kBTU/sq.ft.
Reduce Water Use Intensity	5% reduction (from FY 18/19) to 16.2 gal/sq.ft.
Reduce Energy Expenses	10% reduction (from FY 18/19) to $6.1 million
Reduce Water & Sewer Expenses	10% reduction (from FY 18/19) to $1.1 million

Strategies for Achieving Energy and Water Goals

Also included are a list of recently completed energy conservation measures (ECMs) as well as identified potential ECMs that would reduce utility costs and use. Prior to completing an ECM, Facilities Operations considers the cost effectiveness and overall impact on the university.

In order to ensure that limited funds are spent efficiently, Facilities Operations must prioritize conservation measures by considering potential savings. Figure 3 highlights the 15 most energy intensive campus buildings. While ongoing efficiency work occurs in as many buildings as possible, this map serves as guide of where the biggest potential utility savings exist.

Figure 3. FY 20/21 – Biggest Energy Consumers



Sustainability Commitments and State Mandates

The following provides a brief background on several university and state-mandated initiatives that guide energy and water consumption goals.

- **Climate Action Plan** – Appalachian State University published the 'AppCAP 1.0:" A vision for Climate Neutrality' was published in 2020 and serves as a roadmap to guide the University with actionable and achievable steps to reach climate neutrality.[1]
- **American College & University Presidents' Climate Commitment** – 2008
- **Second Nature Climate Commitment** - Signed by Chancellor Sheri Everts in 2016, this is a commitment from Appalachian State University to reach climate neutrality by 2050.[2]
- **Faculty Senate –** Passed a resolution to achieve climate neutrality by 2035.[3]
- **North Carolina Senate Bill 668** – Passed in 2007, SB 668 promotes the conservation of energy and water use in state, university, and community college buildings. New buildings must be built 30% more energy efficient, renovations must be 20% more energy efficient, and water efficiency in new buildings must be improved by 20%.[4]
- **House Bill 1292** - 2009 – HB 1292 allowed institutions of the University of North Carolina to carryforward unspent annual utility funds that could be documented as a result of installed energy conservation measures. Once awarded, those funds can be spent during the following fiscal year, 60% of which must go towards additional efficiency measures.[5]

  HB 1292 also created state requirements to ensure that states are tracking energy and water consumption data as well as regularly updating strategic energy plans.
- **The UNC Policy Manual** – In 2013, the UNC System stated that UNC institutions must develop plans to become carbon neutral as soon as possible and 2050 at the latest. The Policy Manual also states that climate neutrality is the ultimate goal. [6]
- **Executive Order No. 80 –** In 2018 Governor Cooper established North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy. The plan called to reduce statewide greenhouse gas emissions to 40% below 2005 levels, increase the number of state-owned and leased zero emission vehicles to 80,000, and reduce the energy consumption per square foot in state owned buildings by 40%.[7]

For the purpose of this SEP, the goal of climate neutrality by 2050 is used as the metric for reducing energy and water usage and emission levels. A specific year is selected so that annual reduction goals can be assigned. However, the 2050 timeline should not be a limiting factor as reductions in energy and water use will be pursued as aggressively as possible.

[1] https://sustain.appstate.edu/initiatives/climate-action/
[2] https://secondnature.org/signatory-handbook/the-commitments/#climate-commitment
[3] https://today.appstate.edu/2019/12/20/climate-neutrality
[4] https://www.ncleg.gov/Sessions/2007/Bills/Senate/PDF/S668v0.pdf
[5] https://www.ncleg.gov/Sessions/2009/Bills/House/PDF/H1292v0.pdf
[6] https://sustain.appstate.edu/_documents/UNC-System-Sustainability-Policy.pdf
[7] https://www.ncdhhs.gov/about/department-initiatives/climate-change-and-clean-energy-plans-and-progress

Greenhouse Gas Emissions

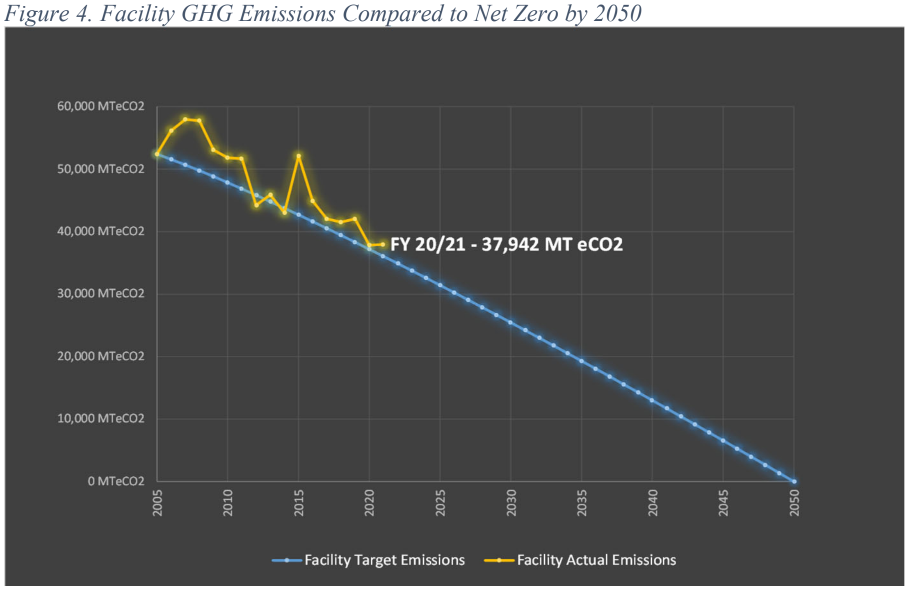
In order to achieve climate neutrality, net greenhouse gas (GHG) emissions[8] will need to be effectively reduced to zero metric tons of equivalent carbon dioxide (MT eCO_2) by 2050. In order to eliminate university GHG emissions, a realistic understanding of current emission levels and annual reduction goals is required. Included in this document are the emissions from electricity and fossil fuels consumed by university facilities and vehicles. Other GHG emissions related to broader university activities are tracked by the Office of Sustainability.

GHG emissions in this SEP are broken down into two categories: facilities and vehicles. Facilities include all campus buildings and other infrastructure that consumes energy (leased facilities, parking lots, athletic fields, etc.) Vehicle emissions track university-owned and leased vehicles from academic departments, App State Police, Food Services, Facilities Operations, Athletics, Traffic, etc. Not included are the AppalCART busses and New River Light and Power who both provide services beyond the university.

Facility GHG Emissions

As indicated in Figure 4, Appalachian State University has seen sustained reductions in GHG emissions. There was a slight increase during FY 20/21 that is most likely attributed to the increased outside air that was supplying HVAC systems during the cold winter months. Historical emissions reductions are steps in the right direction, however, significant work remains.

Figure 4. Facility GHG Emissions Compared to Net Zero by 2050



The 2019/20 SEP established a goal of reducing facility GHG emissions by 17%. Both FY 19/20 and 20/21 were considerably lower (nearly 10%) than 18/19 levels but failed to achieve the 17% target reduction. Potentially more important than progress made on specific reduction goals, the COVID-19 pandemic highlights another issue.

The past two years were unprecedented in terms of campus operations. The systematic and societal changes made in response to the pandemic were significant and demonstrate the magnitude of change that is required to achieve meaningful emission reductions.

[8] GHG estimates are calculated using SIMAP® the greenhouse gas tracking tool used by Second Nature participating schools and universities.

Even with a four-month shutdown in FY 19/20 and a sparsely populated campus during FY 20/21, the university is not yet on track with GHG emissions goals to achieve climate neutrality by 2050.

Facility GHG Goal – Following the linear emissions target, Appalachian State should reduce its facility emissions to 34,905 MT eCO_2. This would represent an additional 8% reduction from FY 20/21. Unfortunately, this reduction will be extremely challenging given the return of campus to pre-pandemic levels.

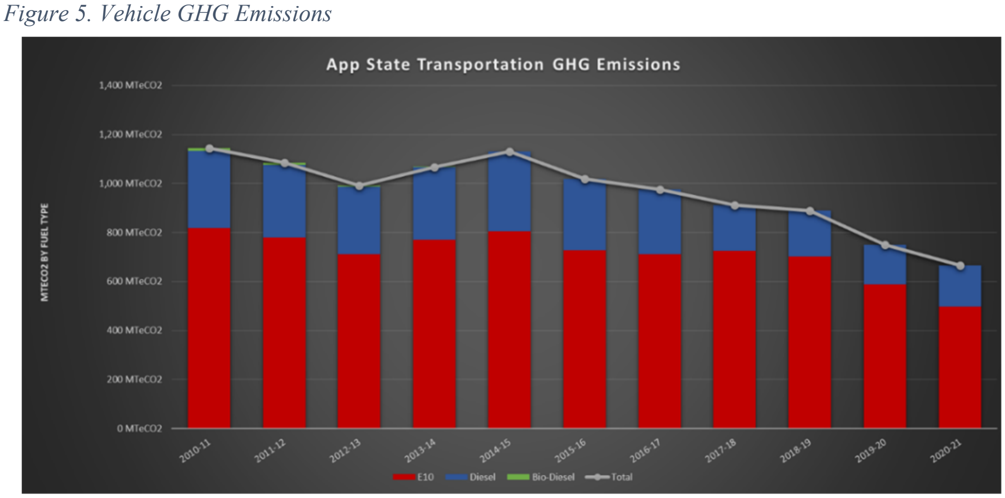
Electrical consumption during FY 20/21 in campus buildings was responsible for 22,272 MT eCO_2 while steam production was responsible for 15,670 MT eCO_2. In terms of reducing greenhouse gas emissions, electricity consumption should be prioritized. In 2022, the university-owned New River Light and Power will begin purchasing electricity from a different supplier. While the conventional source of electricity is natural gas, the new supplier allows for customers to purchase renewably generated electricity at a premium cost.

The University currently plans on purchasing 10% of its electricity from previously existing hydro and is working with other stakeholders to increase that amount to 15%. With that level of investment in carbon-free electricity, the university's facility GHG emissions would be reduced by 3,340 MT eCO_2, making the overall goal of an 8% reduction more attainable. Its important to note that while purchasing renewably sourced electricity will be a key factor in reducing the university's GHG emissions, a delicate balance between investing in on-campus efficiency and offsetting emissions must be considered. In order to truly reduce GHG emissions, the university must reduce its energy usage.

Vehicle GHG Emissions

The amount of university-related travel has significantly been reduced over the past two years during the COVID-19 pandemic. As campus returns to pre-pandemic level, transportation is expected to increase. The following GHG emissions represent the entire university's day-today vehicular activities but do not include AppalCART and New River Light & Power. While this trend is in-line with goals set to achieve carbon neutrality by 2050, significant investment in energy efficient and/or electric vehicles will be required to sustain vehicle emission reductions.

Figure 5. Vehicle GHG Emissions



Electric Vehicles - Under UNC System guidelines, Appalachian State University may only purchase approved utility vehicles. Vehicles owned by the university are referred to as the motor pool. The motor pool is limited to12 passenger vans, box trucks, cargo vans, pickups trucks, and other large utility vehicles unless given special permission by the North Carolina Department of Administration. Passenger vehicles such as sedans, minivans, and sports utility vehicles are leased and are referred to as the motor fleet.

Figure 6. 2019 Chevrolet Volt (EV)

With a relatively low amount of required daily mileage, electric vehicles would likely be suitable replacements for most campus requirements. In order for the university to purchase electric utility vehicles, the Department of Administration has to approve specific vehicles that the university is allowed to purchase. In order to reduce emissions and strengthen the argument for purchasing electric utility vehicles, the university has begun to lease electric vehicles (EVs).

During the 2019/20, the university replaced four older Chevrolet Impalas with four all-electric Chevrolet Bolts. The university also traded a Chevrolet Impala for a plug-in hybrid Chevrolet Volt the previous year. With successful year-around performance of the Chevrolet Bolts, confidence in EV's has increased. There were slight reductions observed in battery capacity during the winter months but did not impact day-to-day operations and increased to original levels again during warmer months.

In addition to reduced point source emissions, savings from fuel and maintenance costs are expected to offset increased vehicle price. Establishing successful year-round operation of the all-electric motor fleet vehicles will strengthen the argument that the Department of Administration should allow electric light duty trucks to be purchased as they become commercially available. The University intends to increase the number of electric vehicles as older vehicles are retired but there has yet to be a specific goal determined for the number of EVs acquired per year.

Facilities Operations currently has five charging stations for five plug-in vehicles. As the fleet of EVs increases, the number of charging stations will need to increase proportionally. This represents an added cost that needs to be factored into the life cycle analysis of each vehicle. Manufacturer recommendations for the Chevrolet Bolt state that the vehicle should be plugged in when not in use to optimize battery efficiency. Once fully charged, the vehicle does not continue to consume electricity.

2021/22 Vehicle Emissions Goal: Reduce emissions by 10% compared to FY 18/19. This reduction would represent a FY 21/22 goal of 800 MT eCO_2 for vehicle emissions

Energy and Water Use

Appalachian State University's campus is approximately 5.6 million square feet and requires significant amounts of energy and water so that occupants are comfortable and safe. Raw FY 20/21 energy and water consumption data is detailed below:

Figure 7. FY 20/21 Campus Consumption

Utility	FY 20/21 Consumption	Percent Change from FY 19/20	Percent Change from FY 18/19
Electricity	47,183,683 kWh	-3%	-13%
Natural Gas	2,944,038 therms	+3%	-4%
Propane	5,653 gallons	-58%	-67%
Gallons of Water	63,169,000 gallons	-12%	-29%

Analyzing energy and water consumption during the COVID-19 pandemic has been challenging. Overall utility consumption over the last two years has been reduced but there are a number of factors (i.e. COVID-HVAC programming and campus occupancy) that have temporarily impacted campus usage.

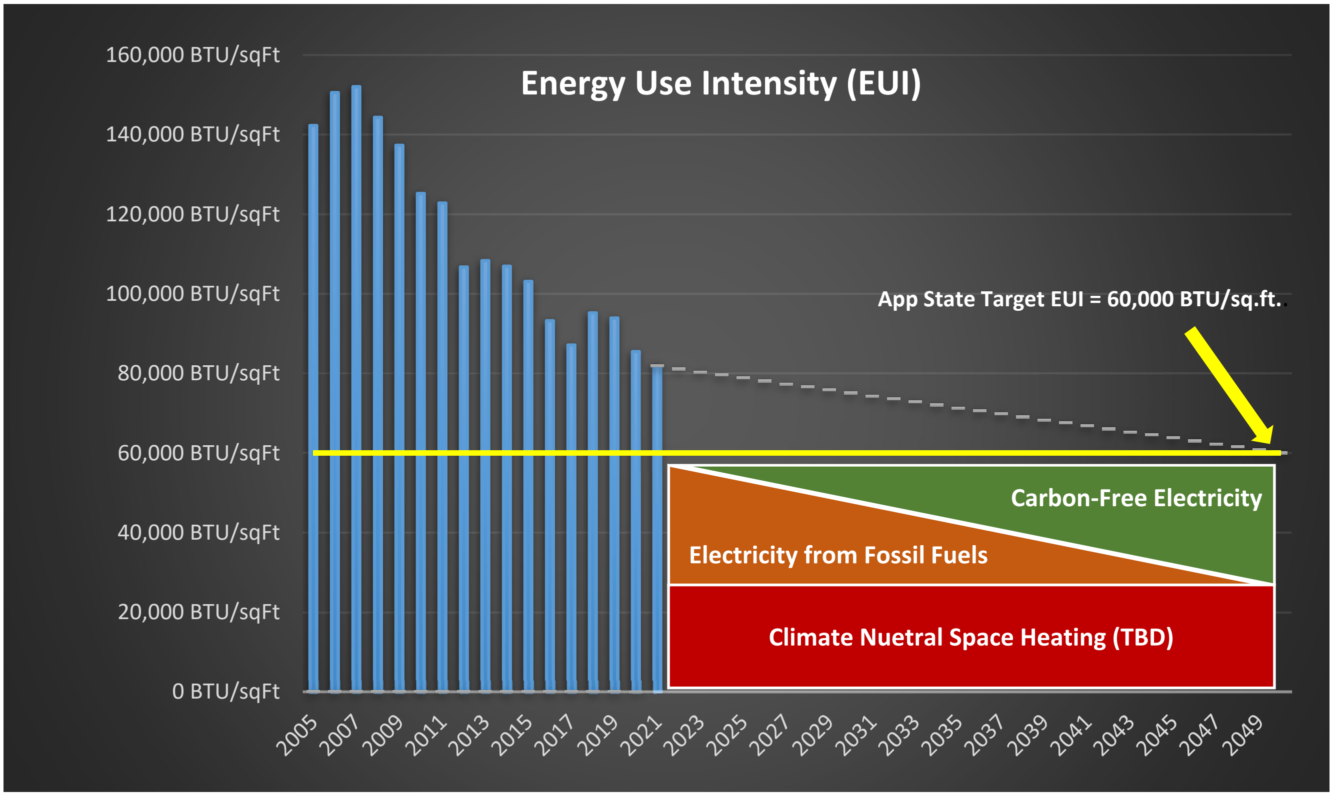
Energy Use Intensity

The University maintains several different types of buildings (academic, housing, dining, arts, athletics, etc.) Because buildings vary in size, use, and design, comparing the amount of energy and water consumed between buildings requires establishing comparable metrics. Energy use intensity (EUI) and water use intensity (WUI) allow different types of buildings to be compared by analyzing consumption on a per square footage basis. For EUI, everything that uses energy (lighting, heating, etc.) is compared to the gross square footage of campus.

There is currently no shortage of efficiency opportunities at App State but determining the lowest possible EUI requires considering two factors: remaining efficiency opportunities and funding commitments. Facilities Operations has set the target (lowest reasonably possible) EUI to be 60,000 BTU per square foot (sq.ft.). Figure 8 shows that App State's current EUI is 81,851 BTU per sq.ft. In order to achieve the EUI target goal by 2050, the university must reduce campus EUI during FY21/22 by 1%.

With campus activity returning to pre-pandemic levels and several high occupancy dormitories coming online, EUI will likely increase instead of decrease. Facilities Operations will continue aggressively implementing efficiency projects in order to minimize the energy increase. Moving forward with energy efficiency projects in existing buildings is key to reducing EUI but ensuring that newly constructed and renovated campus buildings are designed and constructed with aggressive energy efficiency standards will have an even greater impact on the university's future EUI and must be prioritized.

Figure 8. Actual and Target Energy Usage Intensity

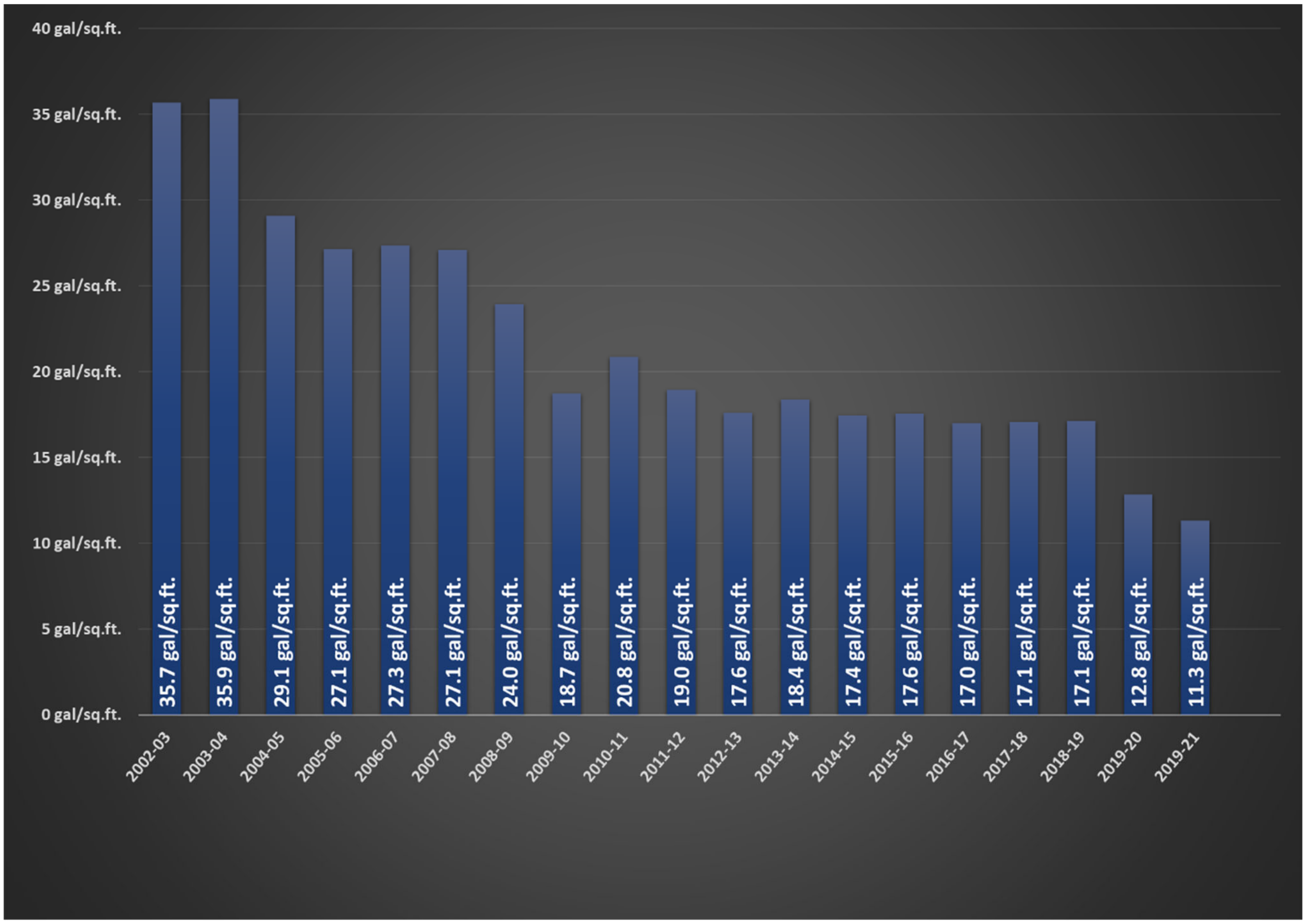


Water Use Intensity

Similar to EUI, water use intensity (WUI) analyzes water consumption across the entire campus. In this report, WUI is expressed in gallons per square foot.

Figure 9 tracks the university's WUI since the 2002/03. The amount of water consumed on campus has decreased since then due to increased attention to maintenance like eliminating leaks and installing low flow fixtures. Unfortunately, the WUI has been largely flat during recent years of full campus occupation.

Figure 9. Water Usage Intensity History



WUI Goal for 2020/21

As with EUI, WUI is expected to increase as the university resumes campus activities. In order to stay on track to meet long term WUI reduction goals while also being realistic about campus occupancy, the university will set the goal to reduce WUI 5% from 2018/19 levels to 16.2 gallons per square feet.

Going forward, the university must prioritize water efficiency in both existing buildings and new construction. During FY 21/22, Facilities Operations will increase attention towards identifying potential water efficiency projects in specific campus buildings.

Energy and Water Expense

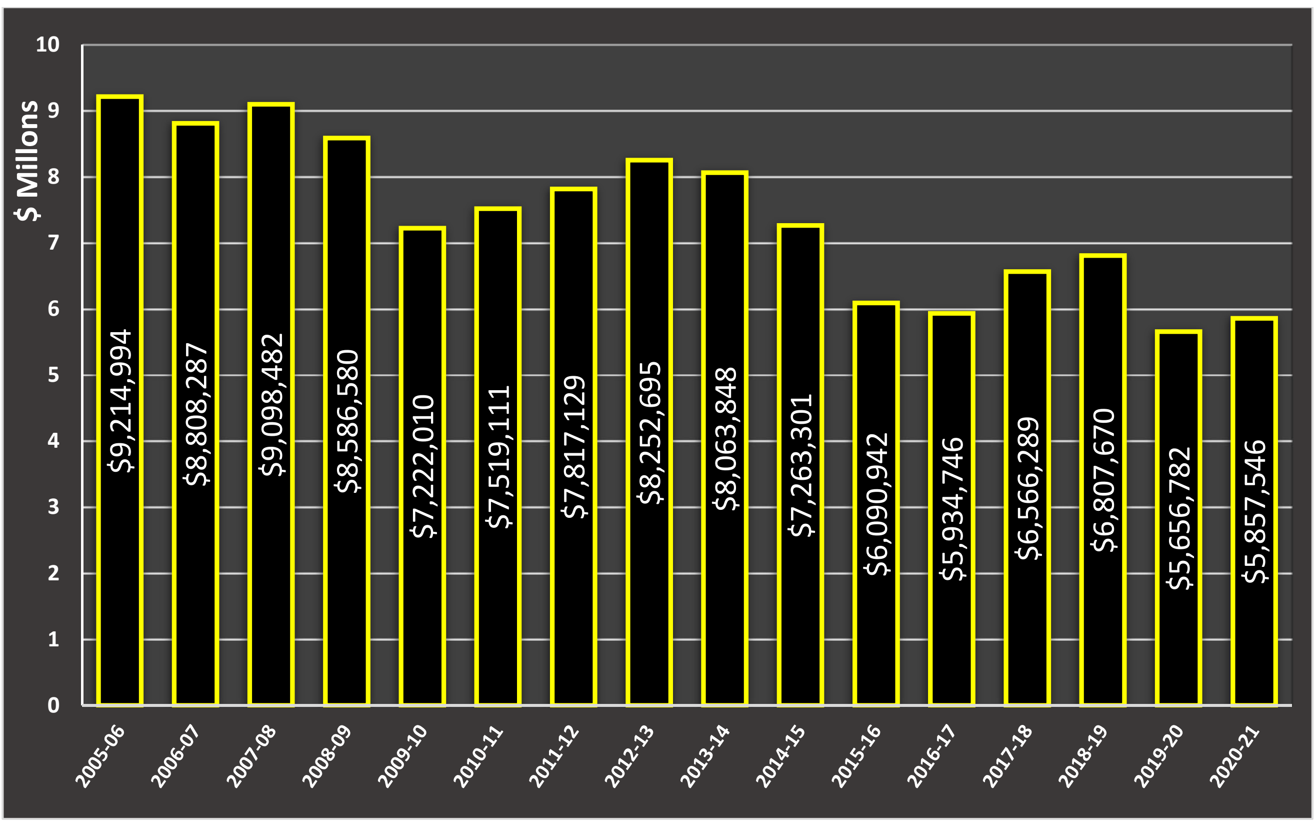
The amount of energy and water required by the university creates significant financial obligations and must be considered when determining future strategies. Reducing utility costs for the university helps strengthen resiliency during financially difficult periods as is evident with the current COVID uncertainties.

Energy

Figure 10 tracks total annual energy expense for all campus buildings. This includes the raw cost of electricity and natural gas and does not include billed rates from the steam plant that cover operating costs.

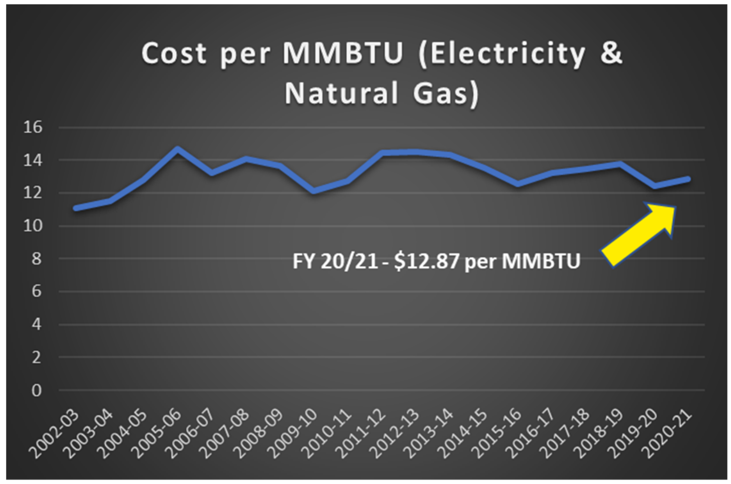
Energy expenses increased from FY 19/20 to 20/21 but are still significantly lower than FY 18/19.

Figure 10. Total Annual University Energy Expense



The cost of energy has a direct impact on the university's overall energy costs. There has been a marked decline in the amount of energy consumed and the total amount spent on energy but the combined cost of electricity and natural gas (measured in $/MMBTU) has not had a discernable trend.

Figure 11. Historical Energy Cost per MMBTU

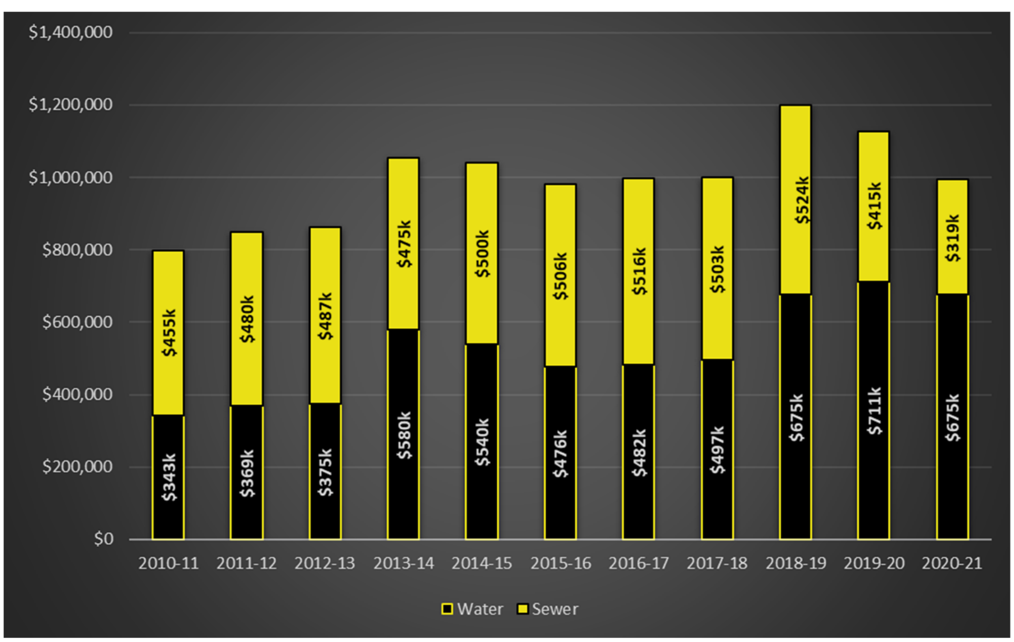


With various factors affecting the costs such as fuel supply, weather, and political influences, the price of energy over the last 19 years makes predicating future energy costs difficult. The conventional assumption is that the long-term cost of energy will increase but as the adoption of renewable energy increases and as the commercially-available supply of natural resources fluctuates, predicting future energy prices remains challenging.

Water and Sewer

The university has two costs associated with the water that is consumed on campus, water supplied and sewer costs. The majority of campus receives water from the university owned and operated water plant. The Town of Boone supplies water to 14 additional meters. The Town of Boone charges sewer fees for all of the water consumed on campus whether supplied from the University or the town.

Figure 12. Yearly Water and Sewer Expenses



FY 20/21 water and sewer costs decreased slightly even though actual water consumption was reduced by over 26 million gallons over the past two years. Water expenses have built in overhead and repair costs that are not necessarily correlated to the amount of water consumed.

Utility Expense Goals for FY 21/22

- **Energy Expense Goal** for FY 21/22 is to reduce costs by 10% compared to 2018/19 levels which would equate to $6.1 million in total utility costs.

  With a significant number of unknowns surrounding this coming school year and the COVID-19 pandemic, predicating campus energy expense requires a balance between being realistic about increased energy use with a commitment to aggressively implementing efficiency projects. While electrical use is expected to increase as classroom activities resume, New River Light and Power's new supplier of electricity should reduce costs for conventionally sourced electricity. With longer daily HVAC schedules, natural gas (steam) usage will also likely increase.

- **Water & Sewer Expense Goal** – Reduce costs by 10% compared to FY 18/19 levels. This reduction would equate to $1.08 million.

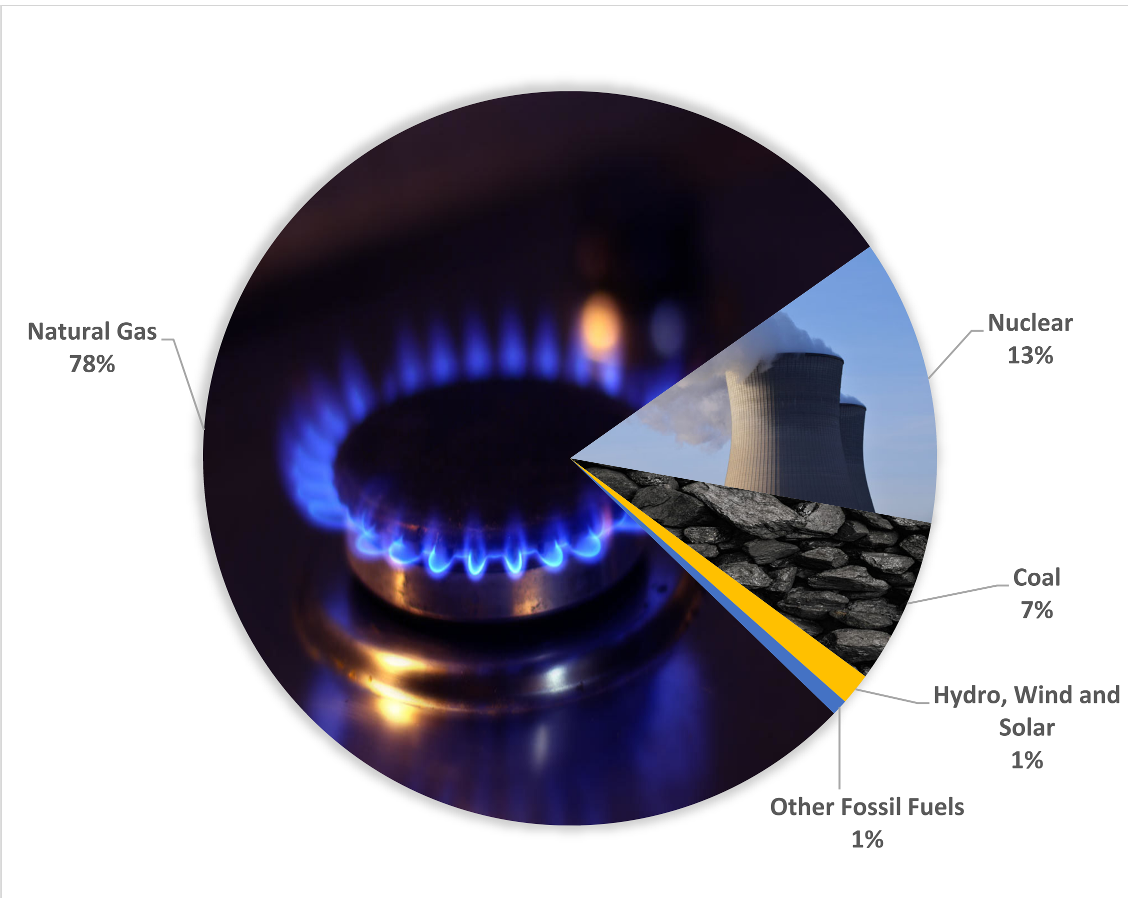
  University water expense incorporates a number of factors that are different from energy. Because the university owns and operates a water plant that serves the majority of campus, there are fixed operational costs that are not directly linked to consumption and the price of water per gallon has been increasing over the past several years.

Campus Energy Portfolio

Steam and electricity are the two primary types of energy used to operate campus facilities. The university's steam plant primarily operates on natural gas and uses fuel oil as a backup fuel source. University-owned New River Light and Power purchases electricity from Blue Ridge Energy who purchases power from Duke Energy. A small portion of energy is provided by on-campus renewable energy systems.

Total energy consumed on campus during 2020/21 was 455,047 MMBTU. This includes both steam and fossil fuel consumption. The following figure provides a breakdown of the sources of total energy (electricity, steam, and other heat) based on campus fossil fuel usage and Duke Energy's portfolio[9].

Figure 13. Facility Combined Energy Supply Portfolio



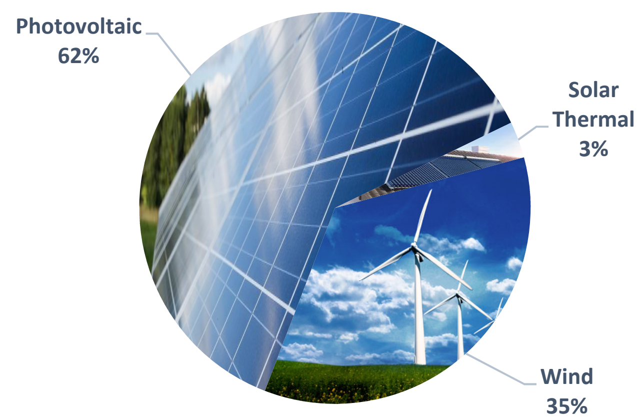
[9] www.duke-energy.com/annual-report

On-Campus Renewable Energy

The university has several renewable energy systems on campus. Appalachian State University's Renewable Energy Initiative (ASUREI), a student-led, student-funded committee has been the primary funder of renewable energy installations to date.

In FY 2020/21, on campus renewable energy systems produced 231,053 kWh of electricity and 25 MMBTUs from functioning solar thermal systems. On campus renewable energy provided 0.18% of the university's total energy use. Figure 14 details the breakdown of on-campus renewable energy production.

Figure 14. On-Campus Renewable Energy



Unfortunately, there is significantly more solar thermal capacity installed on campus than what is being operated. The lack of utilization has been due to unanticipated maintenance costs and labor requirements to keep systems operational. Less than 10% of the total solar thermal capacity on campus was operating during 2020/21.

Due to limited site and resource availability as well as the associated maintenance costs of wind energy, the university is currently prioritizing photovoltaic (solar-electric) as the preferred on-campus type of renewable energy system.

Opportunities – ASUREI has contracted with an engineering firm to design a 100 kW PV system that would be installed behind the data center on State Farm Rd. Once complete, the system is expected to produce approximately 153,600 kWh annually.

Figure 15. On-Campus Renewable Energy Production 202/21

	Annual Production
Broyhill Wind Turbine	82,845 kWh
Leone Levine Photovoltaic (PV)	79,764 kWh
Legends Electric Vehicle Charging Station PV	6,991 kWh
Library Traffic Circle PV	6,536 kWh
Frank Hall PV	50,751 kWh
Kathrine Harper/Kerr Scott PV	1,447 kWh
Peacock Mountain PV	2,749 kWh
Plemmons Student Union Solar Thermal	24,033,583 BTU
Varsity Gym Solar Thermal	1,149,309 BTU

Funding Energy Projects

With COVID-related budget shortfalls, the importance of implementing energy and water savings projects is even more apparent. Limited project funding will require low-cost projects to be prioritized. This will also provide an opportunity to prepare and prioritize larger capitol energy projects so that when funding does become available, the university can move forward. The following is a list of previously used and potential funding sources for on-campus energy projects.

- **Appalachian State University** – In addition to student and faculty commitment to sustainability, Facilities Operations has an engrained and pragmatic approach toward efficiency and self-sufficiency. With ongoing operations and maintenance, Facilities staff work to increase the longevity and efficiency of equipment at the university. The university's Electricians, HVAC, Controls, Preventative Maintenance, Zone Maintenance, Motor Pool, and Steam shops continue to provide reliable services that extend the lifespan of university-owned facilities and equipment. Facilities Operations intends to continue to make significant investments in energy efficiency as funding allows.
- **Energy Saving Performance Contracts (ESPC)** – The university has used ESPCs as a way to fund energy measures installed with no upfront cost to the university. The contractor claims savings throughout the life of the savings and while this has been an effective way to get a number of efficiency projects installed on campus, actual savings have been much less than predicted. Since ESPCs are not responsible for maintenance, reliability and occupant comfort, university staff have devoted significant resources towards troubleshooting installed ESCO efficiency measures.

  Alternatively, efficiency measures installed by university staff have reduced energy by 24% with less overhead and have typically resulted in high occupant satisfaction and system reliability. The university is not currently considering ESPCs as a way to fund energy projects.
- **Renewable Energy Initiative (ASUREI)** – A student-funded and student-operated program that implements on-campus renewable energy systems and energy efficiency projects. The ASUREI has been the primary funder of on campus renewable energy projects and has also contributed to a large number of Facilities Operations efficiency upgrades and projects.
- **North Carolina House Bill 1292** – provides UNC system schools the opportunity to retain unspent allocated utility funding to be used for energy projects. Colleges and Universities must show that the 1292 savings being claimed have been a direct result of previously installed efficiency projects on academic and administrative buildings.

  The university submitted a 1292 application for 2021/22 that identified $650k in 1292-eligible energy savings. Facilities Operations has prepared a budget proposal for how best to spend those funds. Potential projects include: installing steam meters in campus buildings, upgrading VAV boxes to digital, LED upgrades, building automation system training for staff, and various other energy saving projects.

2019/20 Completed Energy Projects

The following list of energy conservation measures were implemented during FY 20/21. As noted, some projects may require additional work during FY 21/22.

- Energy Analyst – Facilities Operations hired Chris Caudill to analyze campus consumption and implement energy saving projects.
- Campus-wide temperature and scheduling policy
- Advanced Scheduling with Events2HVAC in Chapel Wilson, Holmes Convocation Center, Garwood, Belk Library, and Katherine Harper Hall. Events 2 HVAC is currently operating in 115 classrooms.
- Design Guidelines – Each specific shop in Facilities Operations reviewed and provided feedback on the university's most recent design guidelines. The biggest challenge was balancing reliability and efficiency. Two major improvements included: a building envelope section and a path forward for the university to consider high efficiency boilers and chillers. Final revisions will be made by Design and Construction during FY 2021/22.
- DD Dougherty – Entire building LED lighting upgrade.
- Broyhill Music – Implemented nightly static pressure reset that slightly reduces the velocity of air flow while still maintaining necessary ventilation, temperature, and humidity requirements for the building and musical instruments
- Collaboration between Facilities Operation and ASUREI
  - College of Education – ASUREI purchased a new network engine that was installed during the summer of 2021. A static pressure reset was added to the six air handlers. The additional capacity will also allow for improved optimal start / stop as well as the demand limiting, load rolling function.
  - Pipe Insulation was installed at the Student Rec Center Mechanical Rooms and the Turchin Arts Center. Funding was allocated for pipe insulation improvements at the convocation center but an upcoming project may require selecting another building (Rankin West, Peacock Hall, or the Belk Library maybe suitable alternatives).
  - Convocation Center – Lights were purchased for LED upgrades at the loading dock and will be installed by App State electricians as soon as possible.
  - Rankin Geology Showcase Lighting – Upgraded to LED (Estimated 71% reduction, offsetting over 48,000 kWh per year)
- Holmes Convocation Center – Arena Occupancy Sensors that control arena game lights, six air handling units, and the two destratification fans (ongoing).
- Belk Library – Discharge air temperature reset on air handlers.
- Roess Dining Hall – Previously operating 24/7, Facilities Operations worked with Campus Dining to implement HVAC scheduling based on building need.

- Living Learning Center – The Controls Shop Implemented a schedule in the building that had been previously operating 24/7 like the residence wing.
- Garwood Hall Roof Replacement – Primarily a roof replacement project completed by Design and Construction , roof insulation values were more than doubled to R-24. Existing roofing was covered with two layers of 2 inches of rigid foam insulation prior to the new roofing be installed.
- LS Dougherty hot water system was updated to digital control which allowed implementing a heating occupancy schedule.
- Founders Hall - installed digital control valves that provide the ability to reset based on outside air and indoor temp, modulate pump speed, and schedule the HVAC system (previously operating 24/7).

Identified Potential Projects

The following list of projects have been identified as potential measures the university can pursue to reduce energy consumption and overall utility costs. This list is not intended to be either a complete list or serve as a goal for FY 21/22, rather a list of known projects. Energy saving potential, cost effectiveness, funding, and labor availability will be considered when prioritizing and selecting projects.

- **Temperature and Scheduling Policy**
    - Confirm all zones in BAS are complying with temperature setpoint policy.
    - Extend HVAC schedules in buildings that can be further broken down into smaller areas. (I.e. if there is one evening class in Anne Belk hall on the third floor, the entire building does not to be conditioned at night).
- **Advanced Scheduling with Events2HVAC**
    - Currently installed in 115 classrooms, Evenst2HVAC has kept those areas unoccupied over 60% of the time during normal occupied hours. The next step for Events2HVAC would be to implement in areas with occupancy sensors that currently set areas into a standby and allow for a temperature drift and flow reduction. With Events2HVAC, occupancy sensors would return zones to unoccupied mode early for scheduled space if there is no activity at the start of an event.
- **Building Submetering**
    - Install power and steam meters in campus buildings with anticipated 1292 carryforward funds. By installing meters that interface with the university's building automation system, Facilities Operations will be able to track energy usage in real time, reduce response time to problem areas, and implement demand management strategies.
    - *Challenge* – Implementing a preventative maintenance plan to ensure long term accuracy of meters.

- **Chilled Water System Optimization**
    - Calculate and evaluate KW/ton for each chiller (should be less than 1.0) and prioritize chilled water systems based on efficiency and operating costs.
    - Energy management team will consider: pump speed control, whether or not a differential pressure reset is being used, temperature difference (Delta T) between supply and return temperatures on secondary and tertiary pumps, and any VFDs not actively modulating.
- **Demand Controlled Ventilation** (DCV)
    - DCV represents an opportunity to reduce energy use and improve indoor air quality. By installing zone sensors that measure carbon dioxide, humidity, and temperature, Facilities Operations can modulate the amount of incoming outside air based on the actual number of occupants in a room. During unoccupied periods, DCV will allow FO to monitor and respond to relative humidity.
    - *Challenge* – Accuracy on Sensors – If programming of sensors is driven by a single zone's maximum reading, one faulty sensor could drive outside air rates. Additionally, because older buildings have lower designed outside air rates, sensors are needed in every zone and FO would need to implement a sensor maintenance plan.
- **Building Re-Tuning**
    - Continue actively monitoring building performance. Buildings are prioritized by highest utility costs and follow Pacific Northwest National Laboratory's Building Retuning program.
- **Pipe Insulation**
    - Identify piping that need insulation. Steam, condensate, chilled water pipes continually receive maintenance and often insulation is either damaged or not replaced. The university does not employ insulators and currently has to contract out work which can be cost prohibitive.
    - Known buildings with significant pipe insulation deficiencies: Peacock (condensate), Anne Belk (chilled water), Convocation Center (steam inside lower mech room), Student Rec Center, Edwin Dunkin, Rankin West, Steam Stations
- **LED Upgrades**
    - Appalachian State University is committed to upgrading all campus lighting to LED. In order to be cost effective, App State intends to complete as much work as possible with in-house electricians. Facilities Operations has tentatively set the goal to upgrade at least three buildings per year.
    - Buildings with completed bulb count and cost analysis: Holmes Convocation Center, Chapell Wilson, and the academic wing of the Living Learning Center

- *Challenge* – Both of the University's energy saving performance contracts included lighting upgrades from T-12 fluorescent to T8 fluorescent. Both contracts include loan payments. With the first contract payoff occurring in April 2022, there will be 12 more buildings that are ready to be upgraded. LED installs can still be considered in buildings under the second performance contract but the university will be making loan payments until 2028 so cost justifications must consider these costs.
- *Lighting Controls* – Most of the university's lighting is either controlled by conventional on/off switches or occupancy sensors that are not connected to the building automation system. Going forward, the university must decide how best to control lighting. Integrating a building's lighting system while also using occupancy sensors is likely a cost-effective solution that will allow the university that lights are cut off at a specific time each night.

Other HVAC & Controls

- Beginning with the College Street Chiller Plant, test sequence of operation control for free cooling using existing plate and frame heat exchanger during winter so that chillers can be turned off seasonally. *Challenge* – mitigate freezing concerns by using belt driven cooling tower in reverse.
- Building Pressure Setpoints – Most buildings contain building pressure setpoints so that buildings are slightly positive. There is not standard setpoint and there may be efficiency opportunities by identifying a standard minimum building pressure setpoint.
- Discharge Air Temperature and Static Pressure Resets – Determine which buildings could incorporate or improve these reset strategies.
- Hot water resets – Determine which buildings could look at zone need rather than outside air temperature to reset the hot water supply temperature (typically between 120 and 180). Requires a digital thermostat in each zone.
- VAV Box Occupancy Sensors – Currently Installed in Peacock, Anne Belk, Leon Levine, and Sanford Hall. Determine maximum temperature drift (1.5 deg F) and minimum flow (not 0 CFM) to increase efficiency and minimize comfort concerns.
- Investigate overcooling to determine if modifying minimum occupied flow setpoints can reduce overcooling and save energy without impacting occupant comfort. ASHRAE (2019) suggests that minimum flow setpoints should be closer to minimum ventilation rate calculations (typically 10 to 20% of designed maximum flow).
- Warm / Cool Adjusts – Determine if there are any remaining warm/cool adjusts that can override campus temperature policy. Also determine if warm/cool adjust should remain active if temperature adjustments can only increase efficiency (I.e. if they do not make a room any cooler during the summer, only warmer)

- **Steam Efficiency**
  - Determine if installing an economizer on the number 4 steam boiler is a viable project given life expectancy of boiler.
  - Repair and/or improve pipe insulation in numerous campus buildings.
  - Identify areas where condensate return could be improved.
  - Continue testing steam traps repair as needed.
  - Test all heat exchangers.
  - Scan all high, medium, and low-pressure steam valves and lines ultrasonically for leaks. Repair when practical.

Building Specific Opportunities (alphabetical order)

- **Anne Belk**
  - Air Handler Unit 1 currently operates 24/7 as AHU1 is conditioning a server room on the first floor. Installing a mini-split in the telecom room would allow AHU1 to be scheduled and would pay for itself in less than 1 year. Facilities Operations is currently working with the IT department to determine the best path forward. If discussions become prolonged, the Controls Shop could implement a nightly static pressure reset.
  - Chiller Optimization - Implement improved hot water reset for pneumatically-controlled spaces. Need to determine feasibility of creating a new sequence and disperse several wireless DDC thermostats for zone verification and temperature protection.
- **BB Dougherty**
  - Chiller replacement upgrade. This project would also represent an opportunity to switch to a more benign refrigerant.
  - Determine if AHU 2 outside air intake can be increased to increase economizing capability.
- **Belk Library**
  - With recently purchased SNE, implement a static pressure reset. This would require reprogramming each N2 VMA. Other potential controls strategies include incorporating optimal start/stop, CO_2 reset, hot water and chilled water resets, and reprogram heat recovery system to provide a low-level economizer.
  - Determine how the dampers on the heat wheel bypass can be better sealed.
  - Review existing demand limiting load rolling programing and enable.
  - Conduct a thorough pipe insulation analysis and repair insulation as needed.

  - Occupancy control on HVAC & lights in study rooms

- **Bookstore/College Street Chiller Plant**
  - Utilize free cooling via plate and frame heat exchanger. Mitigate freezing concerns with new sequence of operation that uses belt driven cooling tower in reverse.
  - Potential controls modifications: implement variable condenser water flow, condenser water temperature reset, and chilled water reset.
  - Chiller loop extensions - utilize shared chillers with varied chiller sizes to keep chillers running in optimal range.
  - Replace remaining Metal Halide light with LED
- **Broyhill Wind Turbine**
  - Decreased output is anticipated in renewable energy systems but there appears to be an optimization opportunity at the Broyhill Wind Turbine. Since 2009, there has been a 20% reduction in kWh output.
- **College of Education**
  - Install ceramic window film technology on south and west facing windows to reduce solar heat gain and ease cooling demand.
  - With recently installed SNE, continue making improvements to the optimal start programing and demand limiting, load rolling programming that is not yet activated
  - With numerous comfort complaints and BAS adjustments, this building would be a good candidate for recommissioning.
- **Edwin Duncan**
  - Building is being considered for major renovations. No additional work should be considered.
- **Dining Hall**
  - With an additional network engine, there are various building automation control strategies that could be implemented such as reprogramming older N2 VMA programming and improve hot water resets.
- **Garwood Hall**
  - Consider expanding Events2HVAC beyond basic classrooms. Would have to be done in coordination with Phoenix fume hood system.
  - Chilled water reset - Would require installing zone humidity sensors in rooms
  - Improved hot water and chilled water resets.
  - LEDs are currently only installed in the first-floor hallway have been upgraded. Existing T-8 fluorescent bulbs are part of the second performance contract but since the

building is consistently the top energy consumer on campus, need to conduct cost benefit analysis considering 7 remaining years of contract payments.

  - Determine if the Garwood machine shop exhaust system can be separated from the first-floor exhaust system. Currently the fan operates continuously when it could be controlled manually when needed.
  - Determine if outside air intake could be reasonably increased to better take advantage of economizing AHU.

- **Holmes Convocation Center**
  - Occ Sensors for the arena game lights, x6 AHUs and two destratification fans. These sensors were purchased with FO funds in 20/21 but have yet to been installed.
  - Upgrade remaining non-LED lighting. Although this building was part of the second performance contract, lighting was not part of the scope of work.
  - Install digital pre-heat valves (ball) on the AHUs. This would prevent steam from leaking through causing more load on the chillers.
  - Determine chiller optimization potential as well as hot water reset options.
  - Long Term: Advocate for roof replacement and insulation improvement (currently less than 4” of XPS on sloped areas). Would reduce energy costs, mitigate condensation issues, and serve a s a potential location for roof top solar (with a standing seam roof and minimal required roof penetrations.
- **John E. Thomas**
  - Upgrade 150+ VAV boxes form pneumatic to digital for increased control strategies. During 21/22, the controls shop is upgrading boxes in DD Dougherty which has less than a third of the boxes that are in this building and will serve as an excellent training opportunity.
  - Chiller replacement would serve as an opportunity to reduce energy consumption and switch to a more benign refrigerant.
- **Kathrine Harper Hall**
  - Mechanical Room – Relocate or section off IT equipment that is located in the mechanical room that stays above 80 degrees. Currently there is a Cool Cube 10, 10,000 BTU/hr. capacity (10amps x 115 v) running 24/7.
  - Upgrade all lighting to LEDs – Part of the first performance contract, the final payment will be made in April of 2022. Based on the use of the building, occupants are present late in the evenings using various labs and often lights are left on overnight.

- **Kidd Brewer Stadium**
    - Install ceramic window film on east (field facing) and west windows. East windows would likely only need films on the 6 & 7 floors as awnings block majority of direct sun on lower levels.
    - Break HVAC schedules into additional zones and schedule accordingly.
        - 6th floor separate game suites and offices. Game suites do not need to be continuously conditioned. 7th floor except for telecom in suite 7026. Consider adding mini-split unit.
    - Program / schedule two AHUs not currently controlled by BAS. Determine if bringing into BAS is practical or if scheduling at existing Trane thermostats is possible.
    - Determine if retuning opportunities exist with DAT and SAP resets, ERV operation, and other potential optimization modifications.

- **Leon Levine**
    - Boiler Staging / Optimization – Currently the four condensing boilers are operating below 90% efficiency.
    - Address overcooling that is evident. Consider reducing occupied minimum flows while balancing occupant comfort and ventilation requirements.
    - Consider installing ceramic window films on exterior of building. Even though some areas are over cooled, there are others that receive a significant amount of solar gain.
- **LS Dougherty**
    - Add controllers to bring mini-spilt systems that condition offices on exterior walls into Metasys.
    - Consider window replacements. Existing windows are single pane and many cannot properly close.
- **Peacock**
    - Continue to monitor preheat valves for failure. Consider upgrading to digital valves. Primary issue is to determine why preheat valves continue to fail. Even though there is higher incoming steam psi, valves are rated for this pressure.
    - Survey airflow setpoints (minimum and maximum), especially in DDC rooms.
    - Consider installing ceramic window film on exterior glazing. Building has poor thermal envelope. Options for insulating exterior walls are limited.
    - With ASUREI and Office of Sustainability, determine and resolve operational issues with Mountain PV array.

- **Plemmons Student Union**
  - Incoming outside air for AHU 1 uses an uninsulated wall chase and warms incoming OA. Example - When the actual outside air temperature was 36 degrees F, the incoming outside air temperature sensor read 56 degrees F.
- **Rankin West**
  - With the recent chiller r'newal completed to prolong life of unit and bring equipment back to manufacturer's specifications, need to determine what optimization strategies exist.
  - Determine if abandoned make up air unit (with functioning steam preheat) could be incorporated to increase the amount of outside air and increase economizing capability.
- **Rankin South**
  - Determine if building can be scheduled with a nightly static pressure reset or similar.
- **Shaefer Auditorium**
  - Determine feasibility of using free cooling during winter months by enabling the chiller's plate and frame heat exchanger. Determine if cooling tower is belt driven and capable of being operated in reverse.
- **Student Recreation Center**
  - Determine feasibility of improving hot water and chilled water resets
  - Obtain a quote for adding a preheat coil after the cooling coil on AHU 3. This could improve economizer and dehumidification operations.
  - DHU's have third party controls with minimal modifications by University Control's shop. Determine potential for optimization.
  - Circulation pump for the pool operates under manual control (third party controllers).
  - Install safe access to outside air intake to allow for regular cleaning of intake. Currently not safely accessible and intake is clogged.
- **Varsity Gym**
  - Intakes for six air handling units in main gymnasium need to be deep cleaned to minimize flow restriction.
  - Bring mini-splits that serve the staff gym into Metasys.
- **Walker Hall**
  - Improve indoor air quality, occupant comfort, and energy efficiency by increasing the amount of outside air, balance system, and increase thermal storage to reduce the number of times the chiller operates.

Campus-Wide Potential Water Projects

- Evaporation credits - Included in one of the university's ESPCs, the university has yet to realize the savings associated with sewage fees being based on the amount of water supplied to cooling towers. While some new metering may be required, determine if there is a path forward with the Town of Boone as evaporation credits would represent a low-cost financial savings opportunity that is common practice for large facilities.
- Conduct campus-wide water audit, identify building specific water efficiency measures, and prioritize project proposals.
- Low flow fixtures - Update urinals and toilets to low-flow fixtures in new buildings and major renovations. A number of older buildings' sewage systems may not be well-suited for ultra-low flow water devices. Buildings must be evaluated on an individual basis.
- Scheduled test and tunes to ensure toilets, urinals, and faucets are in good order and operating at peak efficiency. This process would be performed once a year in each building on a rotating basis.
- Determine feasibility of closed loop HVAC options that would reduce consumption.

ECU Strategic Energy & Water Plan (2021-2022)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

General

The preparation of the 2021 - 2022 ECU Strategic Energy and Water Plan involved consolidating responses by the departments in Campus Operations related to procedural changes or projects that contributed to the conservation of energy or water. This year's plan documents Campus Operations' successes related to energy and water conservation based on the availability of funding sources, be they operating, repair and renovation, or energy savings carry forward.

Analysis

Through the continued efforts of Campus Operations and the East Carolina University community, the institution has realized a 32% decrease in its energy consumption and a 64% reduction in water consumption in 2020-2021 from the FY 2003 baseline. When compared to the previous year, electrical consumption decreased 3.5% while natural gas usage saw a 2.0% decrease.

FY 2021 saw cooling degree-days remain level but heating degree-days increase 10.7% from FY 2020, accounting for some of the increase in #2 fuel oil consumption. The energy consumption data included in this report is "raw" metered data (i.e., it does not take temperature impacts into account when comparing to the baseline year of 2003). To better appreciate ECU's effort to improve energy efficiency, the top chart on page 6, "ECU Annual Energy Consumption" includes a weather-normalized view of the total energy usage per square foot. The weather-normalized EUI (Energy Utilization Index) shows a decrease of 24.7% since our 2002-2003 baseline.

" When compared to the previous year, electrical consumption decreased 3.5% while natural gas usage saw a 2.0% decrease "

ECU continued upgrading campus lighting at Gateway 14th Street Parking Lot, Dowdy Ficklen Ramps, Jenkins Fine Arts Building, Carol Belk Building, and Wright Auditorium House Lighting to LED. We also completed the process of installing energy valves on air handler units to improve chiller plant efficiency, most recently completing this process in Brewster, Fletcher Music, Rivers, McGinnis, and Messick. Because of the reduction in chilled water usage, we have the additional capacity to add more buildings to the loop.

Energy Carry Forward (ECF) funds were also used to continue optimizing the Brewster Building, which consists of four wings. We have completed B-wing and C-wing and plan to complete D-wing optimization this year. Optimization of A-wing has been targeted for this coming year. This optimization project will replace the older pneumatic controls with new electronic controls that will enable us to setback during holidays and periods of lower occupancy.

Total water consumption decreased 36.8% compared to the previous year and water per gross square foot (GSF) has decreased 64% since the 2002-2003 baseline. This large decrease in water consumption was due to students and staff working remotely due to COVID operations and this number should be expected to return to levels in the range of 25gal/sqft to 27gal/sqft upon return to normal operations. Rain Bird Smart Irrigation equipment was purchased with HB 1292 funding and installed on our largest lawn area on Main Campus, which is referred to as The Mall. This will enable our grounds team to reduce unnecessary irrigation because this system utilizes weather and evapotranspiration data and automates the irrigation schedules.

ECU has also been replacing the steam infrastructure on Main Campus. Most recently, the lines between Joyner Library, the Main Campus Student Center, and a portion of the College Hill lines have been replaced. The installation of pre-insulated lines will improve condensate return to the plant and reduce our energy losses in transmission.

On October 29, 2018 Governor Roy Cooper signed Executive Order No. 80 establishing new targets for Greenhouse Gas emission reductions throughout North Carolina. One of the order’s specific actions directs a 40% reduction in energy consumption (per square foot) at state-owned buildings by the end of fiscal year 2025. The baseline is our FY 2003 level.

For ECU to achieve targeted energy consumption goals, substantial reductions must still be realized. These reductions will be the result of both the replacement of less efficient equipment utilized on campus as well as making behavioral changes in how campus facilities are operated. Over the next twelve months, ECU will continue to pursue equipment upgrades, retrofits, and conversions, while also ensuring the campus is operated as efficiently as possible. These endeavors will be undertaken without compromising our primary missions of education and research. This will include such actions as continuing to establish and maintain building operating schedules and defining optimal building operating parameters for energy intensive locations, such as research labs. These efforts, combined with continued campus community education and involvement, will continue to allow ECU to move closer to targeted reductions.

It should be noted that 2021 has been anything but a normal year, especially in terms of campus operations in higher education. A coronavirus pandemic, referred to as COVID-19, caused our university to send students home in the middle of the spring semester 2020. Not long after, the university also instructed most employees to begin working from home which continued throughout most of the summer. As a result of this disruption in usual operations, it is estimated that at least a portion of reductions in our energy and water consumption is due to lower occupancy levels in campus buildings.

Griffin Avin
Chief Sustainability Officer

Paul Carlson
Interim Energy Manager

Chad Carwein
University Sustainability Manager

HB 1292 PROJECTS

External lights in the Gateway Residence Hall parking lot, located on 14th Street were converted to LEDs. This will increase efficiency and safety as well as reduce maintenance costs over time.

Lighting was upgraded to LEDs in the ramps of Dowdy Ficklen football stadium. This will increase efficiency and safety as well as reduce maintenance costs over time.

Lighting was upgraded to LEDs in Jenkins Art East. This will increase efficiency and reduce maintenance costs over time.

Lighting was upgraded to LEDs in Carol Belk. This will increase efficiency and reduce maintenance costs over time.

Lighting was upgraded to LEDs in Wright Auditorium. This will increase efficiency and reduce maintenance costs over time.

Total Project Cost = $586,000 || Projected Annual Savings = $14,031

ECU purchased and installed energy valves on all major air handling units served by Central Chiller Plant #1. The energy valves ensure that we optimize the chilled water flow through the coil; thereby ensuring maximum efficiency and savings on electricity for pumping.

CCP1 Project Cost = $288,000 || Projected Annual Savings = $211,000

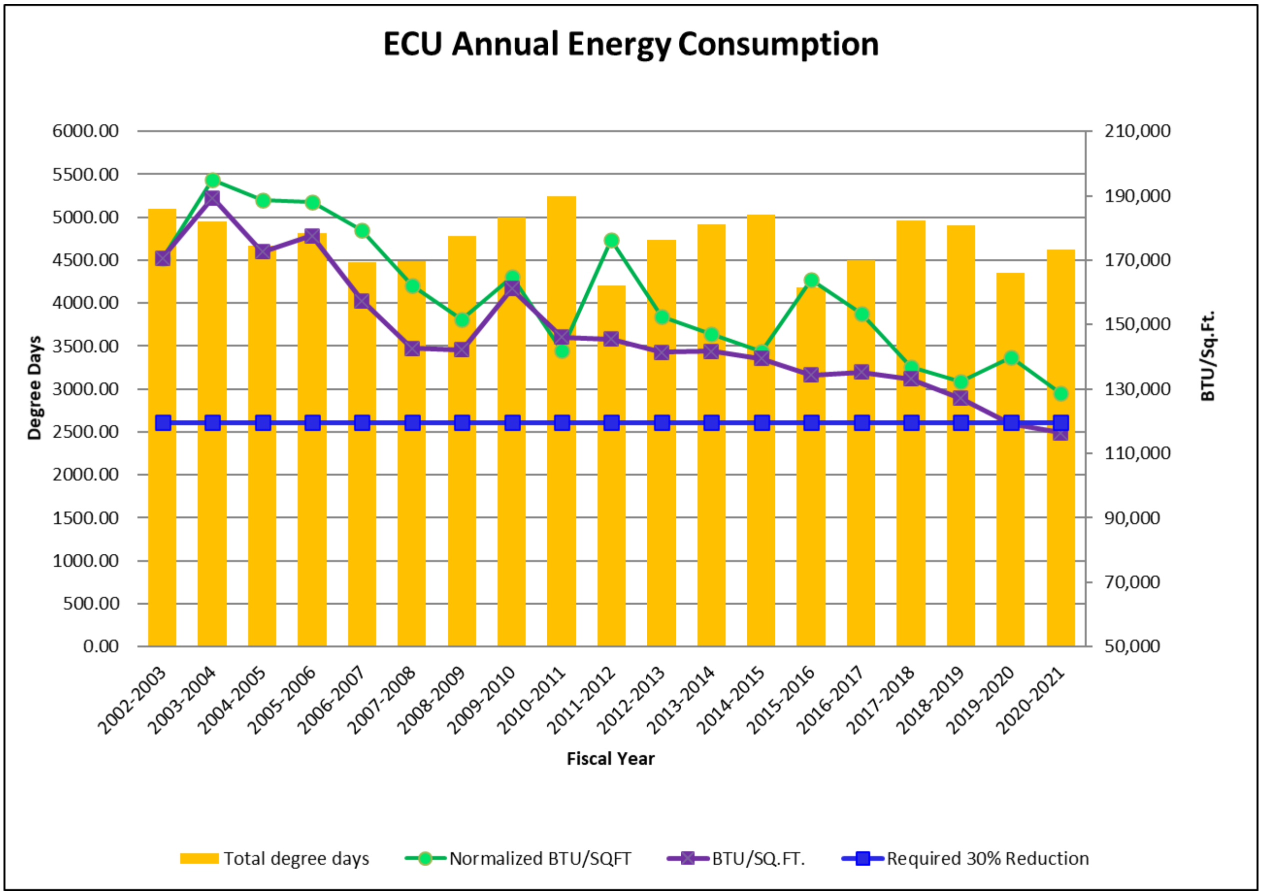
Over the past two years, we have been optimizing the HVAC systems in the Brewster Building. The major upgrade has been to replace obsolete pneumatic controls with electronic controls, which enable Facilities staff to tie this into a building automation system (BAS). BAS allows us to put schedules in the building during breaks and develop real-time consumption trending data.

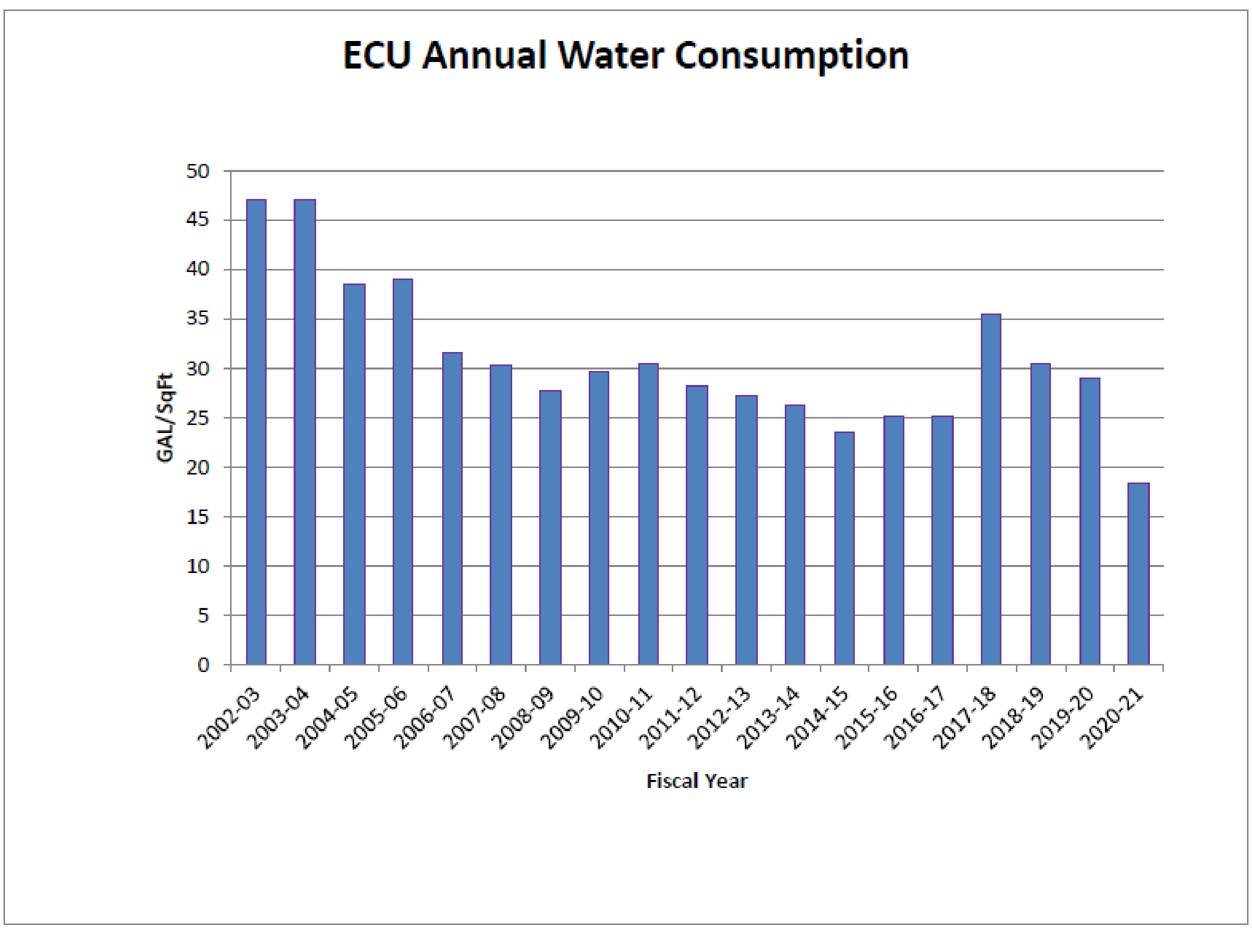
C-Wing Project Cost = $333,600 || Projected Annual Savings = $20,249

In the Science & Technology Building, we funded the replacement of obsolete digital controls with new, upgraded building automation system (BAS). This will allow improved monitoring and scheduling of the HVAC system and we will be able to schedule the buildings based on occupancy levels.

S&T Project Cost = $240,000 || Projected Annual Savings $13,291

Summary of referenced data





ENERGY PERFORMANCE SUMMARY

(Data is not weather-normalized)

Fiscal Year	Total Utility Costs	Cost / MMBTU	Cost / GSF	BTU / GSF	% Change from 2003
2002-2003	$11,021,822	$12.50	$2.13	170,724	-
2003-2004	$12,661,561	$12.32	$2.33	189,287	10.9%
2004-2005	$14,277,138	$14.29	$2.47	172,569	1.1%
2005-2006	$17,129,124	$16.66	$2.96	177,567	4.0%
2006-2007	$17,297,153	$16.30	$2.56	157,404	-7.8%
2007-2008	$17,569,897	$17.14	$2.44	142,573	-16.5%
2008-2009	$18,924,248	$19.16	$2.72	142,207	-16.7%
2009-2010	$19,658,784	$17.71	$2.86	161,238	-5.6%
2010-2011	$18,392,943	$17.84	$2.61	146,059	-14.4%
2011-2012	$18,151,180	$17.58	$2.56	145,433	-14.8%
2012-2013	$17,942,582	$17.15	$2.42	141,416	-17.2%
2013-2014	$17,883,685	$17.13	$2.43	141,752	-17.0%
2014-2015	$18,628,334	$17.97	$2.51	139,480	-18.3%
2015-2016	$16,361,605	$15.93	$2.14	134,410	-21.3%
2016-2017	$15,864,576	$15.35	$2.08	135,262	-20.8%
2017-2018	$15,364,652	$14.88	$1.98	133,158	-22.0%
2018-2019	$16,022,036	$15.18	$1.93	127,096	-26%
2019-2020	$15,604,175	$15.50	$1.85	119,270	-30%
2020-2021	$14,372,208	$14.87	$1.73	116,452	-32%

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Schneider Electric PME Technical Support	Subscription renewed	Renewed	$0	0	$15,000	0	Griffin Avin	FY 2021 HB1292 Funds
Utility Manager utility data collection	Subscription renewed	Renewed	$0	0	$20,000	0	Griffin Avin	FY 2021 HB1292 Funds
Calibrate WAGES meters on HSC to ensure data accuracy	Accuracy of all WAGES meters verified	Complete	$0	0	$5,000	0	Paul Carlson	FY 2021 HB1292 Funds
Explore opportunities for installing a large-scale solar array	Rooftop Solar Feasibility Study	Proposal Received and Being Reviewed	$0	0	$0	0	Griffin Avin / Chad Carwein	N/A

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Schneider Electric PME Technical Support	Subscription renewed	Renewal in process	$0	$0	$15,000	0	Griffin Avin	FY 2022 HB1292 Funds
Dude Solutions Technical Support	Subscription renewed	Renewal in process	$0	$0	$19,464	0	Griffin Avin	FY 2022 HB 1292 Funds
ChargePoint Commercial Cloud Plan	Subscription renewed	Renewal in process	$0	$0	$1,974	0	Griffin Avin	FY 2022 HB 1292 Funds

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Expand buildings utilizing Events-To HVAC building scheduling software	Integration Completed	Incomplete	TBD		$5,000	0	Griffin Avin	FY 2021 HB 1292 Funds
Replace Flow Stations - Warren Life Sciences	Installed and operating	Complete	TBD		$25,000	0	Gray Hamill	COVID-19 Funds
Upgrade Controls for BSL-3 Labs - Warren Life Sciences	Installed and operating	Complete	TBD		$500,000	0	Gray Hamill	COVID-19 Funds
Install thermal window film SODM CSLC (2)	Film Installed	Complete	$1,972		$20,000	0	Donald Crawford	FY 2021 HB 1292 Funds
Upgrades Controls from pneumatic to DDC - Brewster Area C	Controls upgrades	Complete	$20,249		$350,000	0	Ray Schmit	FY 2021 HB1292 Funds
Upgrades Controls from pneumatic to DDC - Brewster Area D	Controls upgrades	Incomplete	$30,000		$525,000	0	Ray Schmit	FY 2021 HB1292 Funds
Upgrade lighting to LED - Wright Auditorium House Lighting	LED lighting installed	In Progress	$700		$200,000	0	Randy Howard	FY 2021 HB 1292 Funds
Heated Steam Blankets - Central Plant Boilers	LED lighting installed	In Progress	$40,000		$118,000	0	Randy Howard	FY 2021 HB 1292 Funds
Upgrade Controls - Carol Belk (1st and 2nd Floors)	Controls upgrades	Complete	$18,250		$115,125	0	Randy Howard	FY 2021 HB 1292 Funds
Install thermal window film SODM CSLC (1)	Film Installed	Complete	$986		$10,000	0	Randy Howard	Operating Funds
Retro-commissioning CCP1 and CCP2	Retro-commission	In Progress	$145,000		$400,000	0	Randy Howard	FY 2021 HB 1292

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Steam trap replacements HSC	New traps installed		$50,000	TBD	$30,000	0	James Roberson	FY 2022 HB 1292 Funds
CCP3 Retro-commissioning	Retro-commission		$15,000	TBD	$75,000	0	Ray Schmit	FY 2022 HB 1292 Funds
Install thermal window film SODM CSLC (x3)	Film Installed		$11,500	TBD	$30,000	0	Donald Crawford	FY 2022 HB 1292 Funds
BAS Upgrades - Brewster A Wing	Upgrade Controls		$25,000	TBD	$425,000	0	Ray Schmit	FY 2022 HB 1292 Funds
BAS Upgrades - Carol Belk (3rd Floor)	Upgrade Controls		$25,000	TBD	$49,175	0	Ray Schmit	FY 2022 HB 1292 Funds
BAS Upgrades - HSC CUP	Upgrade Controls			TBD	$44,610	0		FY 2022 HB 1292 Funds
VAV Controller Replacement - Old Cafeteria Building	Replace Controls		$5,000	TBD	$64,928	0	Griffin Avin / Paul Carlson	FY 2022 HB 1292 Funds
VAV Controller Replacement - Rivers Building	Replace Controls		$20,000	TBD	$148,000	0	Ray Schmit	FY 2022 HB 1292 Funds
VAV Controller Replacement - Flanagan	Replace Controls		$25,000	TBD	$217,250	0	Ray Schmit	FY 2022 HB 1292 Funds

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
University - Participate in the Appalachian Energy Summit	Attend Energy Summit in 2021	Attended Virtually	N/A	N/A	N/A	0	Chad Carwein	N/A
University - Participate in the Mid-Year Energy Summit	Attend mid-year meeting in 2021	Attended Virtually	N/A	N/A	N/A	0	Chad Carwein	N/A
University - Host Climate and Healthcare Conference at EAHEC	Hold conference in February 2021	Cancelled Due to COVID	N/A	N/A	$300	0	Chad Carwein and several Health Sciences partners	State Funds - HSC Sustainability
Attend Virtual AASHE Conference	Sustainability Manager attend and 4 students	Attended Virtually	N/A	N/A	$750	0	Chad Carwein	State Funds - HSC Sustainability
Host 5th Annual Sustainability Film and Discussion Series	Monthly screenings held virtually in fall 2020 and spring 2021	Hosted Virtually	N/A	N/A	$1,200	0	Chad Carwein	State Funds - HSC Sustainability
Sustainability Manager gives guest lectures and group presentations	About 10-12 presentations per semester	Presented Virtually	N/A	N/A	N/A	0	Chad Carwein	N/A
Continue implementation of first ECU Sustainability Plan	Continue Implementation	Continued Implementation	N/A	N/A	N/A	0	Chad Carwein	State Funds - HSC Sustainability
Continue Green Office Program	Sign up 1-2 additional offices per semester	Not Completed Due to COVID Remote Staff	N/A	N/A	N/A	1 (intern)	Chad Carwein	State Funds - HSC Sustainability
Finish Shut the Sash Campaign	Put up stickers and handout flyers in BSM	Not Completed Due to COVID Remote Staff	N/A	N/A	$0	0	Chad Carwein	State Funds - HSC Sustainability
Complete Greenhouse Gas Emissions Inventory	Complete FY 2019-20 Report in Fall 2020	Completed	N/A	N/A	$300	0	Chad Carwein	State Funds - HSC Sustainability
Install 4 additional EV Charging Stations funded through the 2020 CFAT Grant	Funds on hold for the time being	Installed 3 Funded through Volkswagen Settlement Funds	N/A	N/A	$13,000 (in-kind)	0	Chad Carwein	State Funds - TBD

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Participate in the Mid-Year Energy Summit	Attend Mid-Year Energy Summit		N/A	N/A	$0	0	Chad Carwein / Griff Avin	N/A
Participate in the Appalachian Energy Summit	Attend Energy Summit		N/A	N/A	$0	0	Chad Carwein	N/A
Participate in the Sustainability Alliance meeting	Attend Alliance Meeting		N/A	N/A	$0	0	Chad Carwein / Griff Avin	N/A
Attend AASHE Conference	Attend conference in October 2019		N/A	N/A	$500	0	Chad Carwein	State Funds - HSC Sustainability
Host Sustainability Film and Discussion Series	Monthly screenings in fall 2019 and spring 2020		N/A	N/A	$600	0	Chad Carwein	State Funds - HSC Sustainability
Sustainability Manager Guest Lectures and Group Presentations	About 10-12 presentations per semester		N/A	N/A	$0	0	Chad Carwein	N/A
Shut the Sash Campaign	Finish BSM		N/A	N/A	$0	0	Chad Carwein	State Funds - HSC Sustainability
Update Construction Standards	Incorporate Energy and Water Efficiency Measures		N/A	N/A	$0	0	Griffin Avin	N/A
Begin implementation of first ECU Sustainability Plan	Begin implementation		N/A	N/A	$0	0	Chad Carwein	State Funds - HSC Sustainability
Complete Greenhouse Gas Emissions Inventory	Complete FY 2021-22 Report		N/A	N/A	$300	0	Chad Carwein	N/A
Increase ECU presence on social media	Weekly activity on Facebook, Twitter & Instagram		N/A	N/A	$0	0	Chad Carwein	N/A

PAST 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Additional irrigation zones added to IQ irrigation system	Multiple areas to be added	Completed	$5,117		$30,000	0	John Gill	FY 2021 HB1292 Funds

NEXT 12 Months' Activities	Measurement		Savings		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Upgrade existing irrigation zones to IQ "smart" system	Systems upgraded		$5,000		$30,000	0	John Gill	FY 2022 HB1292 Funds
Replace Water Coolers with Bottle Filling Stations - Brewster	Replace Fixtures		$0		$30,000	0	Derrick Anderson	FY 2022 HB1292 Funds

DECLARATION

I have read the 2021-2022 Strategic Energy & Water Plan for East Carolina University. The plan, as presented, supports the reductions required in Senate Bill 668.

William E. Bagnell William Bagnell

William E. Bagnell
Associate Vice Chancellor for Campus Operations

Appendix A - ECU Energy and Water Consumption Data (8/27/2021)

id	year	name	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $	2oil gals	2oil $
60005008	2002-03	East Carolina University	$11,021,822	$9,902,208	791,875,817,767	109,985,914	$7,189,460	3,310,785	$2,167,238	616,666	$545,510
60005008	2003-04	East Carolina University	$12,661,561	$11,528,667	936,015,163,858	119,267,875	$7,928,536	2,656,887	$1,885,347	1,899,088	$1,714,784
60005008	2004-05	East Carolina University	$14,277,138	$13,116,966	917,882,912,624	118,713,800	$7,991,764	3,879,272	$3,965,406	900,600	$1,159,796
60005008	2005-06	East Carolina University	$17,129,124	$15,982,362	959,569,678,473	127,541,706	$9,515,817	4,009,835	$4,909,959	889,854	$1,556,586
60005008	2006-07	East Carolina University	$17,297,153	$16,169,203	992,276,625,512	136,340,808	$10,356,375	5,000,621	$5,515,870	194,821	$296,958
60005008	2007-08	East Carolina University	$17,569,897	$16,405,060	957,302,809,520	137,597,235	$10,469,919	4,558,211	$5,544,054	230,730	$391,088
60005008	2008-09	East Carolina University	$18,924,248	$17,759,453	926,813,234,254	127,507,877	$11,201,911	4,717,022	$6,312,431	144,597	$245,112
60005008	2009-10	East Carolina University	$19,658,784	$18,391,832	1,038,209,248,224	146,053,032	$13,339,960	5,296,665	$4,956,110	73,616	$95,762
60005008	2010-11	East Carolina University	$18,392,943	$16,991,634	952,245,056,990	130,723,115	$12,266,014	5,027,271	$4,694,627	25,169	$30,994
60005008	2011-12	East Carolina University	$18,151,180	$16,671,718	948,122,748,234	132,927,022	$12,258,122	4,934,672	$4,404,444	7,993	$9,151
60005008	2012-13	East Carolina University	$17,942,582	$16,434,614	958,421,842,446	131,203,218	$12,256,099	5,062,869	$4,141,425	32,227	$37,090
60005008	2013-14	East Carolina University	$17,883,685	$16,426,694	959,194,280,326	129,603,483	$12,213,822	4,873,135	$3,986,050	213,957	$226,822
60005008	2014-15	East Carolina University	$18,628,334	$17,173,534	955,773,199,883	131,113,985	$12,964,920	4,743,840	$3,932,161	225,416	$242,708
60005008	2015-16	East Carolina University	$16,361,605	$14,708,103	923,165,595,835	133,239,189	$11,657,520	4,522,260	$2,949,229	111,777	$94,424
60005008	2016-17	East Carolina University	$15,864,576	$14,414,319	939,157,138,141	133,668,444	$11,287,728	4,727,171	$3,059,361	69,196	$58,320
60005008	2017-18	East Carolina University	$15,364,652	$13,753,707	924,549,691,760	124,688,491	$10,385,136	4,623,688	$3,127,684	260,955	$232,800
60005008	2018-19	East Carolina University	$16,022,036	$14,398,661	948,447,689,281	134,210,752	$10,753,197	4,838,459	$3,546,331	42,435	$89,647
60005008	2019-20	East Carolina University	$15,604,175	$13,833,880	892,328,850,520	125,859,519	$10,806,688	4,568,552	$2,955,017	26,769	$50,328
60005008	2020-21	East Carolina University	$14,372,208	$12,971,878	872,390,488,004	121,415,822	$9,807,771	4,477,309	$3,091,731	66,521	$56,794

year	6 oil gals	6oil $	propane gals	propane $	coal tons	coal $	wood tons	wood $	steam klbs	steam $	chw tons	chw $	kgal water	water sewer $	gsf	construction gsf	renovated A/C gsf	stm_eff_factor	chw_eff_factor	cogen_kWh
2002-03	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	238,550	$1,119,614	4,638,344	0	0	1	1	0
2003-04	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	232,629	$1,132,894	4,944,945	0	0	1	1	0
2004-05	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	204,909	$1,160,173	5,318,927	0	0	1	1	0
2005-06	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	210,692	$1,146,762	5,404,001	0	0	1	1	0
2006-07	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	199,017	$1,127,950	6,304,003	0	0	1	1	0
2007-08	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	203,105	$1,164,836	6,714,454	0	0	1	1	0
2008-09	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	180,551	$1,164,795	6,517,338	0	0	1	1	0
2009-10	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	190,872	$1,266,953	6,438,976	0	148,796	1	1	0
2010-11	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	198,150	$1,401,308	6,519,601	0	0	1	1	0
2011-12	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	183,695	$1,479,462	6,519,298	0	0	1	1	0
2012-13	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	183,960	$1,507,967	6,777,321	0	0	1	1	0
2013-14	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	177,610	$1,456,991	6,766,724	0	0	1	1	0
2014-15	0	$0	30,174	$33,745	0	$0	0	$0	0	$0	0	$0	160,672	$1,454,800	6,852,379	0	0	1	1	0
2015-16	0	$0	9,003	$6,929	0	$0	0	$0	0	$0	0	$0	172,498	$1,653,502	6,868,261	0	0	1	1	0
2016-17	0	$0	8,363	$8,910	0	$0	0	$0	0	$0	0	$0	174,935	$1,450,257	6,943,261	0	0	1	1	0
2017-18	0	$0	6,022	$8,088	0	$0	0	$0	0	$0	0	$0	245,693	$1,610,946	6,943,261	519,179	0	1	1	0
2018-19	0	$0	8,614	$9,485	0	$0	0	$0	0	$0	0	$0	227,575	$1,623,376	7,462,440	19,160	0	1	1	0
2019-20	0	$0	25,406	$21,847	0	$0	0	$0	0	$0	0	$0	217,137	$1,770,294	7,481,600	9,791	0	1	1	0
2020-21	0	$0	12,690	$15,581	0	$0	0	$0	0	$0	0	$0	137,395	$1,400,330	7,491,391	139,771	0	1	1	0

id	year	name	energy evaluation						water/sewer evaluation				
			energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
60005008	2002-03	East Carolina University		$2.13	$12.50		170,724			$4.69		51.43	
60005008	2003-04	East Carolina University	-$1,130,619	$2.33	$12.32	-2%	189,287	11%	$105,628	$4.87	4%	47.04	-9%
60005008	2004-05	East Carolina University	-$140,266	$2.47	$14.29	14%	172,569	1%	$388,649	$5.66	21%	38.52	-25%
60005008	2005-06	East Carolina University	-$615,896	$2.96	$16.66	33%	177,567	4%	$365,955	$5.44	16%	38.99	-24%
60005008	2006-07	East Carolina University	$1,368,245	$2.56	$16.30	30%	157,404	-8%	$709,569	$5.67	21%	31.57	-39%
60005008	2007-08	East Carolina University	$3,239,094	$2.44	$17.14	37%	142,573	-16%	$815,644	$5.74	22%	30.25	-41%
60005008	2008-09	East Carolina University	$3,561,260	$2.72	$19.16	53%	142,207	-17%	$997,608	$6.45	37%	27.70	-46%
60005008	2009-10	East Carolina University	$1,081,983	$2.86	$17.71	42%	161,238	-6%	$931,172	$6.64	41%	29.64	-42%
60005008	2010-11	East Carolina University	$2,869,387	$2.61	$17.84	43%	146,059	-14%	$969,942	$7.07	51%	30.39	-41%
60005008	2011-12	East Carolina University	$2,899,180	$2.56	$17.58	41%	145,433	-15%	$1,220,903	$8.05	72%	28.18	-45%
60005008	2012-13	East Carolina University	$3,405,995	$2.42	$17.15	37%	141,416	-17%	$1,349,254	$8.20	75%	27.14	-47%
60005008	2013-14	East Carolina University	$3,357,400	$2.43	$17.13	37%	141,752	-17%	$1,397,859	$8.20	75%	26.25	-49%
60005008	2014-15	East Carolina University	$3,846,835	$2.51	$17.97	44%	139,480	-18%	$1,736,159	$9.05	93%	23.45	-54%
60005008	2015-16	East Carolina University	$3,973,665	$2.14	$15.93	27%	134,410	-21%	$1,732,465	$9.59	104%	25.12	-51%
60005008	2016-17	East Carolina University	$3,779,065	$2.08	$15.35	23%	135,262	-21%	$1,510,135	$8.29	77%	25.19	-51%
60005008	2017-18	East Carolina University	$3,880,142	$1.98	$14.88	19%	133,158	-22%	$730,413	$6.56	40%	35.39	-31%
60005008	2018-19	East Carolina University	$4,942,552	$1.93	$15.18	21%	127,096	-26%	$1,114,360	$7.13	52%	30.50	-41%
60005008	2019-20	East Carolina University	$5,968,057	$1.85	$15.50	24%	119,270	-30%	$1,366,764	$8.15	74%	29.02	-44%
60005008	2020-21	East Carolina University	$6,045,407	$1.73	$14.87	19%	116,452	-32%	$2,526,473	$10.19	117%	18.34	-64%

NOTES:

2013-14 ng therms: 4,973,135 decreased to 4,873,135 due to error in Sept 2013 billing by GUC 3074000 - see FY2014 August Notice tab in Verify GUC Gas Billing Rates worksheet.

2013-14 ng $: $4,065,050 decreased to $3,986,050 to reflect $79,000 credit from error in Sept 2013 billing by GUC 3074000 - see FY2014 August Notice tab in Verify GUC Gas Billing Rates worksheet.

2014-15 KWH $: As of 07/01/14 sales tax on retail sales of electricity increased from 3% to 7%

2014-15 GSF adjusted by +47,386 to include 6 new CSLCs (now operational)

2014-15 GSF adjusted by +95,460 to include 2 CSI facilities previously omitted

2014-15 kWh adjusted by +1,903,914 for addition of CSI & SLC facilities' consumption

2014-15 kWh $ adjusted +$182,081 for addition of CSI & SLC facilities' consumption

2014-15 ng therms adjusted + 17,725 for addition of SLC facilities' consumption

2014-15 ng $ adjusted + $22,377 for addition of SLC facilities' consumption

2014-15 kgal water adjusted +257.167 for addition of CSI & SLC facilities' consumption

2014-15 water sewer $ adjusted + $3,669 for addition of CSI & SLC facilities' consumption

2014-15 propane usage included w/cost - not previously reported

2015-16 GSF adjusted by +15,882 for addition of Brunswick & Davidson SLCs

2015-16 Energy & Water consumption of CSI & 8 SLCs added to GUC totals

2016-17 GSF adjusted by +75,000 for addition of HSC Student Services Bldg

2018-19 GSF adjusted by 213,911 for MC Student Center, 6486 Redional Plant, 208,15 519179

2019-20 GSF adjusted by 14,534 for Uptown 209 and 4626 for Bldg 283 19160

2020-21 GSF adjusted 6,751 for Baseball Hitting facility and 3,040 for Softball hitting fa 9791

id	year	name	$/kwh	$/therm	2 oil $/gal	6 oil $/gal	propane$/gal	coal $/ton	wood $/ton	steam $/mlb	chw $/ton
60005008	2002-03	East Carolina University	$0.0654	$0.655	$0.88	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2003-04	East Carolina University	$0.0665	$0.710	$0.90	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2004-05	East Carolina University	$0.0673	$1.022	$1.29	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2005-06	East Carolina University	$0.0746	$1.224	$1.75	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2006-07	East Carolina University	$0.0760	$1.103	$1.52	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2007-08	East Carolina University	$0.0761	$1.216	$1.70	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2008-09	East Carolina University	$0.0879	$1.338	$1.70	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2009-10	East Carolina University	$0.0913	$0.936	$1.30	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2010-11	East Carolina University	$0.0938	$0.934	$1.23	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2011-12	East Carolina University	$0.0922	$0.893	$1.14	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2012-13	East Carolina University	$0.0934	$0.818	$1.15	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2013-14	East Carolina University	$0.0942	$0.818	$1.06	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2014-15	East Carolina University	$0.0989	$0.829	$1.08	$0.00	$1.12	$0.00	$0.00	$0.00	$0.00
60005008	2015-16	East Carolina University	$0.0875	$0.652	$0.84	$0.00	$0.77	$0.00	$0.00	$0.00	$0.00
60005008	2016-17	East Carolina University	$0.0844	$0.647	$0.84	$0.00	$1.07	$0.00	$0.00	$0.00	$0.00
60005008	2017-18	East Carolina University	$0.0833	$0.676	$0.89	$0.00	$1.34	$0.00	$0.00	$0.00	$0.00
60005008	2018-19	East Carolina University	$0.0801	$0.733	$2.11	$0.00	$1.10	$0.00	$0.00	$0.00	$0.00
60005008	2019-20	East Carolina University	$0.0859	$0.647	$1.88	$0.00	$0.86	$0.00	$0.00	$0.00	$0.00
60005008	2020-21	East Carolina University	$0.0808	$0.691	$0.85	$0.00	$1.23	$0.00	$0.00	$0.00	$0.00

id	year	name	Cost per Therm (100,000 Btu) all Energy Sources								
60005008	2002-03	East Carolina University	$1.92	$0.65	$0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2003-04	East Carolina University	$1.95	$0.71	$0.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2004-05	East Carolina University	$1.97	$1.02	$0.92	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2005-06	East Carolina University	$2.19	$1.22	$1.25	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2006-07	East Carolina University	$2.23	$1.10	$1.09	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2007-08	East Carolina University	$2.23	$1.22	$1.21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2008-09	East Carolina University	$2.57	$1.34	$1.21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2009-10	East Carolina University	$2.68	$0.94	$0.93	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2010-11	East Carolina University	$2.75	$0.93	$0.88	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2011-12	East Carolina University	$2.70	$0.89	$0.82	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2012-13	East Carolina University	$2.74	$0.82	$0.82	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2013-14	East Carolina University	$2.76	$0.82	$0.76	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
60005008	2014-15	East Carolina University	$2.90	$0.83	$0.77	$0.00	$1.22	$0.00	$0.00	$0.00	$0.00
60005008	2015-16	East Carolina University	$2.56	$0.65	$0.60	$0.00	$0.84	$0.00	$0.00	$0.00	$0.00
60005008	2016-17	East Carolina University	$2.47	$0.65	$0.60	$0.00	$1.16	$0.00	$0.00	$0.00	$0.00
60005008	2017-18	East Carolina University	$2.44	$0.68	$0.64	$0.00	$1.46	$0.00	$0.00	$0.00	$0.00
60005008	2018-19	East Carolina University	$2.35	$0.73	$1.51	$0.00	$1.20	$0.00	$0.00	$0.00	$0.00
60005008	2019-20	East Carolina University	$2.52	$0.65	$1.34	$0.00	$0.93	$0.00	$0.00	$0.00	$0.00
60005008	2020-21	East Carolina University	$2.37	$0.69	$0.61	$0.00	$1.33	$0.00	$0.00	$0.00	$0.00

FAYETTEVILLE
STATE UNIVERSITY™

Strategic Energy & Water Plan

July 2020 – June 2022

Executive Summary

Fayetteville State University's **2020-22 Strategic Energy & Water Plan** is in direct support of several key documents.

- American College and University President's Climate Commitment Signatory (2010)
  FSU's Strategic Plan 2020-2025, Strategic Priority 5 – University Sustainability.
    - "Maximize the use of state and federal funds and diversify financial resources
    - Align fundraising efforts with strategic initiatives
    - Align technological investments with strategic priorities in collaboration with academic affairs
    - Build and upgrade physical infrastructure"
- American College and University President's Climate Commitment Signatory (2010)
- FSU's Sustainability Policy (2011)
- FSU's Climate Action Plan (2012)
- FSU's Climate Action Plan (2015)

The purpose of the **Strategic Energy & Water Plan** is to guide the fiscally and environmentally responsible usage of valuable resources per state legislation. Also, striving to educate and encourage students, staff, faculty, and visitors regarding the benefit of energy and water conservation that provide an acceptable level of comfort within the FSU.

Key elements of this **2020-22 FSU Strategic Energy & Water Plan** include:

- Convene the FSU Sustainability Coalition annually and report progress and status on this Plan's goals and objectives
- Implement a Building Manager Program at all FSU facilities
- Incorporate sustainability principles in at least 1 course per semester in the 2020-22 academic year
- Continue working with all departments with energy, water, and other resources consumption, so FSU reduce its carbon footprint and become more environmentally friendly within FSU.
- Identify key opportunities to simultaneously optimize space utilization and energy management goals
- Identify incentive programs from utility providers to reduce utility expenses

North Carolina Legislative Basis for the Plan

Session Law 2007-546 / Senate Bill 668 – Energy consumption per gross square foot to be reduced by 20% by 2010 and 30% by 2015 based on the 2003-2004 fiscal year. Each State institution of higher learning to update its management plan annually and include strategies for supporting consumption reduction requirements. Each university shall submit an annual Strategic Energy Plan to the State Energy Office.

Session Law 2008-203 / Senate Bill 1946 – Energy Efficiency: 30% reduction for new construction projects, 20% reduction for renovation projects (both based on 2004 codes). Water efficiency: for construction/renovation projects 20% reduction in indoor potable water use, and sum of outdoor potable water use and harvested storm water use will be reduced by 50% (based on 2006 NC Building Code). These requirements are mandatory for universities 8/8/2008.

NC Executive Order 156 – State Government Environmental Sustainability, Reduction of Solid Waste, and Procurement of Environmentally Preferable Products.

General Statute 143 64.12 – Utility Saving Initiative for State Agencies and State Institutions of Higher Learning.

UNC-GA Sustainability Policy – Adopted into the UNC Policy Manual on October 9, 2009. References both NC Senate Bills above, as well as portions of UNC Tomorrow.

Plan Goals and Objectives

1. **Increase institutional sustainability by efficiently managing campus resources**
   - 1.1. Educate faculty, students and staff about their roles and responsibilities in energy and water conservation
   - 1.2. Convene regularly and create interactive learning projects to champion culture change
   - 1.3. Coordinate with key external partners to improve FSU’s sustainability efforts

2. **Reduce campus energy and water consumption**
   - 2.1. Design and construct only LEED-Certified or equivalent, high-performing, energy and water efficient buildings
   - 2.2. Include building commissioning in all new construction and major renovation projects
   - 2.3. Implement energy and water conservation measures in campus facilities and operations

3. **Reduce utility expenses by working with utility providers on rates, incentives and other strategies**
   - 3.1. Ensure appropriate utility rate schedules and accurate billing
   - 3.2. Identify and participate in all available utility incentive programs
   - 3.3. Sub-meter campus facilities to facilitate strategies to reduce utility expenses

Goal 1: 1. Increase institutional sustainability by efficiently managing campus resources					
Objective 1.1	Educate faculty, students and staff about their roles and responsibilities in energy and water conservation				
Objective 1.2	Convene regularly and create interactive learning projects to champion culture change				
Objective 1.3	Coordinate with key external partners to improve FSU's sustainability efforts				
2020-21 Activities	**Measurement** **Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
The Green Team / Integrating sustainability into Co-curriculum projects and events	Host educational/awareness events targeting campus users	Complete; multiple events held and successful	Staff time	Sustainability Coordinator	Title III, State
Making climate neutrality and sustainability into FSU academic curriculum and other educational experiences for all students	Educate Early College and FSU students about environmental and sustainability in at least 1 class in every academic year	Complete; 1 or more classes held and successful in Spring 2021	Staff time	Sustainability Coordinator	Sustainability Office
Expand community outreach efforts toward the achievement of climate neutrality	Encourage and educate students via the service-learning program, the Green Team, the academic program, Student Government Association, Bronco Advantage, the sustainability educational material around campus, NCDEQ, and local organizations. Sustainable Sandhills, for example	Done, on-going	Staff time	Sustainability Coordinator	Sustainability Office
Campus Race to Zero Waste among universities within the US and Canada	To be the top 100 ranked among other colleges and universities. Also, to raise environmental awareness and advance our zero-emission reduction by 2035	FSU ranked 116 of 130 universities who recycled the most. Due to COVID-19 we cannot recycled as much because we did not get a service from Waste Management to haul recyclable items	Staff time	Sustainability Coordinator	Sustainability Office
Implement a Building Manager Program in all FSU campus facilities	ID building managers and define roles and responsibilities in all FSU campus facilities	In progress, continue effort in 2020-21	Staff time	Sustainability Coordinator	Title III
Prepare for the FSU GHG inventory for Second Nature in 2019-20	Begin data gathering effort	Complete; On-going	Staff time	Sustainability Coordinator	Title III, State
Implement energy and water conservation measures	Continue to implement measures to improve EUI reductions.	Sustainability Coordinator vacancy limited progress in this area.	Staff time	Sustainability Coordinator	Title III, State
2021-22 Activities	**Measurement** **Expected**		**Investment**	**Assigned to**	**Funding Source**
The Green Team / Integrating sustainability into Co-curriculum projects and events	Host at least 4 educational/awareness projects/events targeting faculty, staff, and students		Staff time	Sustainability Coordinator	Title III, State

Making climate neutrality and sustainability into FSU academic curriculum and other educational experiences for all students	Educate Early College and FSU students about environmental and sustainability in at least 1 class in every academic year	Staff time	Sustainability Coordinator	Sustainability Office
Implement a Building Manager program in all FSU campus facilities	Continue with progress to develop this program, which is now aligned with an EHS initiative lead by Facilities Management Department.	Staff time	Director of Operations	Title III, State
Making climate neutrality and sustainability into FSU academic curriculum and other educational experiences for all students	Convene a faculty-led committee from multiple departments to begin a formal process that also addresses Second Nature reporting	Staff time	Sustainability Coordinator	Title III, State
Campus Race to Zero Waste among universities within the US and Canada	To be the top 100 ranked among other colleges and universities. Also, to raise environmental awareness and advance our zero-emission reduction by 2035	Staff time	Sustainability Coordinator	Sustainability Office
Increase of engagement waste management/recycling initiative among the resident halls	Coordinate with Housing and Residence Life as well as the Building Environmental Department. Train and educate students, staff, and faculty	Staff time	Sustainability Coordinator	Sustainability Office
Partner with the Athletic Department to build campus wide sustainability efforts	Encourage student athletes with renewable energy and sustainability program	Staff time	Sustainability Coordinator	Sustainability Office
Promote Environmental and Sustainability Program at freshman orientation week	Recruit new students into the Green Team as well as inform new students with message and guidance for green living at FSU	Staff time	Sustainability Coordinator	Sustainability Office

Goal 2: Reduce campus energy and water consumption					
Objective 2.1	New construction and major building renovations standard to be LEED-certified and/or high performance				
Objective 2.2	Include building commissioning in all new construction and major renovation projects				
Objective 2.3	Implement energy and water conservation measures in campus facilities and operations				
2020-21 Activities	**Measurement** **Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
Continue design and construction of LEED certified or equivalent, high performance buildings	Lyons Science comprehensive renovation project and any other building	Still in design phase. High performance elements are being incorporated.	Staff time	Facilities Management, Planning & Construction	State, Title III
Include building commissioning on all new construction and major renovation projects	Lyons Science comprehensive renovation project and any other building?	Still in design phase. Building Cx is included.	n/a	Facilities Management, Planning & Construction	State
Incorporate energy use into campus space planning and utilization efforts	Identify key opportunities to optimize space utilization and energy management goals	Current focus is on reducing lab exhaust and better classroom and class lab utilization.	Staff time	Sustainability Coordinator & FM Superintendent - Trades	Title III
Apply for HB1292 Carry-Over funds	Certify eligible savings and carry forward surplus in utility budget for investment in energy saving projects.	There are surplus funds available for carryover to FY 2021-2022	Staff time	Sustainability Coordinator & AVC for Facilities Management	Title III
Retro-commissioning at Science Technology, LSA, and Nursing Building.	Compete the fume hoods and building exhaust	Done, on-going	Staff time	Facility Management	FSU
2021-22 Activities	**Measurement** **Expected**		**Investment**	**Assigned to**	**Funding Source**
Continue design and construction of LEED certified, high performance buildings	Design work continues Lyons Science comprehensive renovation and FSU Health and Wellness Center projects.		Staff time	Facilities Management, Planning & Construction	State
Include building commissioning on all new construction and major renovation projects	Included on Lyons Science and FSU Health and Wellness Center projects.		$110,000	Facilities Management, Planning & Construction	State
Incorporate energy use into campus space planning and utilization efforts	Identify key opportunities to simultaneously optimize space utilization and energy management goals		Staff time	Sustainability Coordinator	State
Apply for HB1292 Carry-Over funds	Certify savings and lobby for a utility budget surplus so that we can take advantage of carry forward to fund energy projects.		Staff time	Sustainability Coordinator	State
PV Solar and Battery Energy Storage for FSU	Clean Power & Industrial Efficiency and PWC are pleased to provide a statement of work to support the cost benefit analysis of multiple alternatives for PV solar and battery energy storage		Staff time	PWC, NC Clean Power & Industrial Efficiency, and FSU Facilities Management	PWC and FSU
Create light switch and water reductions stickers to all buildings	Reduce energy consumption by creating this awareness/reminder		Staff time	Sustainability Coordinator	Sustainability Office

Install/replace motion lighting to both old and new buildings	Design work continues Lyons Science building and other buildings (TBD)	Staff time	Electrical Team/Dpt	FSU
Create sustainability competitions for Residence Halls to commit. For example, the reduction of energy, water, recycling, and food waste	Targeting all Residence Halls and the University Place Apartments	Staff time	Sustainability Coordinator	Sustainability Office

Goal 3: Reduce utility expenses by working with utility providers on rates, incentives and other strategies					
Objective 3.1	Ensure appropriate utility rate schedules and accurate billing				
Objective 3.2	Identify and participate in all available utility incentive programs				
Objective 3.3	Sub-meter campus facilities to inform strategies to reduce utility expenses				
2020-21 Activities	**Measurement** **Expected**	**Actual**	**Investment**	**Assigned to**	**Funding Source**
Review all utility accounts to ensure appropriate rate schedule and accurate billing	Complete annual account review for all electric, natural gas, propane, water/sewer accounts	Done, on-going	Staff time	Sustainability Coordinator	Title III
Work with utility providers to identify incentive programs to reduce FSU utility expense	Document responses and pursue opportunities with all providers	Done, on-going	Staff time	Sustainability Coordinator	Title III
Work with FM Superintendent – Trades to avoid Peak Hours during Winter and Summer time	Monthly reminder and recommend energy saving opportunities to the team	Done, on-going	Staff time	Sustainability Coordinator	Sustainability Office
Subscribe 05 panels of PWC Community Solar	Receive credits and reduces expenses on the FSU monthly bill	Done, on-going	One-time enrollment $60. Monthly subscription $7.65	Sustainability Coordinator	FSU
Submit Acceleration Fund from Second Nature	To stall Electric Charging Stations on FSU Campus	Done, on-going	Staff time	Sustainability Coordinator	Second Nature
Include sub-metering on all new construction and major renovation projects	Install natural gas metering on at least 4 large state-funded buildings	Incomplete	0	Sustainability Coordinator	State, Title III
	Implement a web-based real-time energy and sustainability dashboard application	Incomplete	0		
2021-22 Activities	**Measurement** **Expected**		**Investment**	**Assigned to**	**Funding Source**
Review all utility accounts to ensure appropriate rate schedule and accurate billing	Input monthly account invoice for all electric, natural gas, propane, and water/sewer accounts in database		Staff time	Sustainability Coordinator	State
Work with utility providers to identify incentive programs to reduce FSU utility expense	Propose Capel generator demand response project to FSU administration.		Staff time	Energy Manager	State
Work with higher administrations to identify the setpoint during winter and summer for greater energy saving	Propose the setpoint at 75 degree for summer and 68 degree for winter during the peak hours		Staff time	Sustainability Coordinator	Sustainability Office
Submit Acceleration Fund from Second Nature	To install Electric Charging Stations on FSU Campus and/or other carbon neutrality projects		Staff Time	Sustainability Coordinator	Second Nature
Identify funding opportunities to conservation energy generation and renewable energy projects	Continue the search for a viable financed energy project		Staff time	Sustainability Coordinator	State & NGOs

Include sub-metering on all new construction and major renovation projects	Review options for improving communications capability of existing building level kW demand sub meters	Staff time	Energy Manager	State
	Implement web-based real-time energy and sustainability dashboard application	Staff time		

Declaration

I have read the FSU 2020-21 Strategic Energy & Water Plan. The plan, as presented, supports reductions required in G.S.143-64.12a (minimum 40% reduction in annual energy/water consumption by 2017).

Signed this 29th day of October 2021.

Commitment

- Energy and water management is the responsibility of the occupants at each facility, guided and supported by the FSU Energy and Sustainability Coordinator and FSU Facilities Management and Operations staff.
- The attached plan outlines the activities and expenditures required to reach energy and water consumption reduction goals.
- FSU Department Heads will review progress and results quarterly and will support the FSU Energy Sustainability Coordinator's attendance at Departmental meetings as required.

Strategic Energy & Water Plan Mandate - Goal

Reduce annual Total Energy Consumption by a minimum of 40% by fiscal year 2016-2017 from a baseline fiscal year of 2002-2003.

Strategic Energy & Water Plan Mandate - Measure

Our Key Performance Indicator is *Total Energy Use in BTU per Square Foot per Year.*

Strategic Energy & Water Plan Mandate - Commitment

I have read and support the FSU 2020-22 Strategic Energy & Water Plan.

____
Tai Davis
Director of Facilities Operations

____
Gene Cottrell
Director of Facilities Administration & Budget

____
Jon Parsons
Associate Vice Chancellor, Facilities Management

____
Carlton Spellman
Vice Chancellor, Business & Finance

August 31, 2021

Mr. Reid Conway
NC Department of Environmental Quality
217 West Jones St.
Raleigh, NC 27699

Subject: Strategic Energy Plan – NCSSM

Dear Mr. Conway:

Attached is a copy of the August 31, 2021 Strategic Energy Plan of the North Carolina School of Science and Mathematics.

Thank you for your outstanding support and advice to help NCSSM on this project. As a small institution, your efforts have made it a successful project.

If you have any questions or comments, please contact me at (919) 416-2667 or covington@ncssm.edu.

Sincerely,

Garry D. Covington

Garry Covington
Director of Plant Facilities

Attachment

c: Dr. Todd Roberts – w/Attachment
Mr. Robert Allen – w/Attachment
Mr. Bruce Chisholm – w/Attachment
Mr. Michael Mitchell III – w/Attachment
Ms. Miriam Tripp – w/Attachment

North Carolina School of Science and Mathematics

Strategic Energy Plan

August 31, 2021

Table of Contents

Executive Summary

NCSSM Background

The North Carolina School of Science and Mathematics (NCSSM) opened in 1980 on the site of the former Watts Hospital in Durham, NC. Most of the buildings on campus were built between 1909 and 1953, which is the major cause of many of the energy-related problems, and regular maintenance and repair issues. NCSSM's campus is on the National Register of Historic Places because of the Watts Hospital.

NCSSM is the first residential public high school in the country for juniors and seniors with an interest in science and mathematics. NCSSM is a constituent high school member of the UNC System, and is a public high school. It does not charge tuition or student fees for students to attend the school. The legislation creating NCSSM was strongly advocated by Governor Hunt, and it was approved in 1978 with the Speaker of the House of Representatives casting the deciding vote since the NC House was evenly divided about NCSSM.

Since its fledgling start, NCSSM has continued to be under funded and neglected since it opened in 1980. NCSSM continues to direct its limited funding to the academic and student residential program. However, NCSSM’s physical plant infrastructure needs a significant infusion of additional funds to keep the plant facilities in operation. One explanation for the under-funding of NCSSM is that there was significant doubt whether or not NCSSM would survive ten years. It should be noted that Durham County donated the Watts Hospital to the State of North Carolina with the provision that if the school closed within 12 years, the facility would be returned to Durham County.

There are over 350 other public high schools in North Carolina, but NCSSM is the only high school that has been required to absorb the various State of North Carolina budget reductions just like state agencies and the University of North Carolina institutions. In the past NCSSM has often been required to absorb these cuts even though it has no student fees or tuition, or local funds to support it like the other public high schools or UNC System institutions.

Scorecard Results

Considering the impact of a growth of 29% student equivalents, 34% staff, and 22,323 (5.0%) square feet, NCSSM reduced its annual Total Energy Consumption since the base year of 2002-03. **Comparing energy consumption per staff-student equivalent in 2020-2021 with the baseline year of 2002-2003, electricity usage decreased 38.3%, natural gas usage decreased 30.7%, and water usage decreased 56.7%. Total energy consumption per student equivalent decreased by 33.6% from the baseline year.** In 2020 – 2021, there were 432 online, 490 distant learning students, and 62 workshop students. The on-line students stay on campus during extended weekends. The student equivalents are calculated using conservative estimates of 5% of a full-time residential student for on-line students, 20% for workshop students, and 1% for distance learning students. The student-staff equivalents are calculated as: number of staff, plus number of student equivalents.

Baseline Utility Use

The energy use mix of the North Carolina School of Science and Mathematics is approximately 55% electricity, 30% natural gas, 15% water and sewer, and 0% fuel oil. Comparing 2020-21 with the previously year, natural gas usage decreased 1%, electricity usage decreased 11%, and water usage decreased 16%.

NCSSM's Annual Utility Report is included in the Appendix. It identifies the usage and cost information for each type of energy source at NCSSM. As noted in the Scoreboard Results, NCSSM increased its annual Total Energy Consumption in 2019-20 compared to the base year of 2002-03, due to the increase in the number of students, staff, workshops, and online students coming to campus. However, **comparing the total staff-student equivalents in 2021 with 2003, total energy consumption (BTU) per staff-student equivalent decreased by 33.6%, and water usage per student equivalent decreased by 56.7%**

Key Actions

The following actions have helped NCSSM reduce its overall net energy usage:

- Monitor natural gas usage
- Plan to Continue Utility Accounting
- Energy Management Awareness
- Conservation Awareness Team
- State Energy Office Recommendations
- HVAC – Chiller Repairs and Renovations
- Lighting Performance Contract
- Steam Leak Repairs
- Guaranteed Energy Saving Performance Contract
- Replacing Air Handler Units and Controls

Savings Estimate & Financial Evaluation

A detailed review of the financial evaluation of the energy usage is included in Section 1 of the Strategic Energy Plan. NCSSM is continuing to develop and implement an energy conservation program. It is continuing to explore various energy management projects such as performance contracts. NCSSM has upgraded the lighting throughout the campus to LED through the system wide performance contract. NCSSM is currently in the construction phase of a guaranteed energy savings performance contract. This contract includes water savings areators and flush valves, LED parking lot and gymnasium lightings and HVAC controls. The reduction in usage (per staff-student equivalent) of 38.3% in electricity, 30.7% in natural gas, and 56.7% in water, resulted in a $306,155 cost avoidance. Because of COVID, it is difficult to compare 2020 -21 to previous years. For the entire school year, the residence halls operated at half capacity. This contributed to some of the utility savings. However; this still required 100% HVAC operation for the residence hall and academic classrooms. Some of the water savings were offset by students and employees washing their hands more frequently for longer periods of time.

Goals and Measures
NCSSM has an overall goal to reduce the annual Total Energy Consumption. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM's students, additional buildings on campus, and added staff members.

1. Baseline Energy Use

Based on NCSSM's growth of 29% in student equivalents, 34% in staff, 5.0% in square feet, total energy consumption has decreased since the baseline year of 2002-03 by 33.6%. Other items affecting NCSSM's energy consumption is the addition of two emergency (natural gas) generators for student safety, students remaining on campus during the summer months for research, additional summer workshops with more residential participants, running one boiler during the summer months to maintain heat and reduce mold, and online students residing on campus during extended weekends.

NCSSM Energy Consumption

	2019-20	2002-2003	Increase/Decrease	Percentage	Increase/Decrease per Staff-Student Equivalent
Electricity Use (kwh)	6,876,022	7,774,573	-898,551	-11.5%	-38.3%
Natural Gas Use (therms)	437,880	440,442	-2562	-0.6%	-30.7%
Water Use (1,000 Gal.)	10,377	16,714	-6,337	-37.9%	-56.7%

As indicated in the table above, **electricity usage decreased by 38.3%, natural gas consumption decreased by 30.7%, and water usage decreased by 56.7% (based on staff-student equivalent) from the baseline year 2002 – 2003.**

The budget reductions during the past several years have made it difficult to compare the usage and expenditure information between years. The Office of State Budget and Management's required reversions forced NCSSM to carry over June 2003 expenditures to be paid in July 2003. The carry over caused the expenditures to be understated in 2002-03 and overstated in 2003-04. The energy consumption information above and in the Appendix has been restated to show the actual June 2003 expenditures and usage in 2002-03 and 2003-04. The adjustment shows the expenditures and usage in the year in which the consumption actually occurred.

The energy use mix of the North Carolina School of Science and Mathematics is approximately 55% electricity, 30% natural gas, 15% water and sewer, and 0% fuel oil. The natural gas is used to provide heat for the campus buildings, the 680 residential high school students from throughout North Carolina, 387 online students, and 289 staff (permanent and temporary) positions. Natural gas is also used to provide hot water and emergency power to the campus.

2. Planned Actions & Projects

2.1 Plan to Continue Utility Accounting

During 2020-21 NCSSM will continue to maintain the Utility Accounting process to track the cost and usage of electricity, water, natural gas, and fuel oil. The Utility Accounting database will follow the guidelines of the State Energy Office, and it will remain in an electronic spreadsheet format. The data will be used to prepare the Annual Utility Cost and Usage Summary Report in September 2022 to the State Energy Office.

2.2 Energy Management Awareness

NCSSM will use various methods to make the NCSSM community (students and staff) aware of the impact of energy management, and the importance of reducing the energy consumption at NCSSM.

- The Sustainability Awareness Group will hang signs/posters in key locations encouraging people to conserve energy and water.
- Include energy management messages in the "Daily Unicorn," which is a daily publication of current events on campus.
- Provide electronic updates about energy management to all students and staff through the Sustainability Awareness Group.
- Include Energy Management as an All School Day Session at NCSSM / for all students and staff.

2.3 Conservation Awareness Team

The NCSSM Conservation Awareness Team will promote conservation education and behavioral changes for all facility users. Since NCSSM is a residential public high school for juniors and seniors, it is a continuing process since there is a 50% turnover in the student body each year. The team includes the following NCSSM staff and students:

Name	Position
Robert Allen	Vice Chancellor for Finance and Operations
Garry Covington	Director of Plant Facilities
Bruce Chisholm	Assistant Director of Plant Facilities
Dr. Katie O'Conner	Vice Chancellor for Academic Programs (Leader of Sustainability Group)
Michael Mitchell	Utility Manager (Electrician)
Todd Bollinger	Grounds Supervisor (Sustainability Advisory Group)
Jon Davis	NCSSM Faculty (Sustainability Advisory Group)
NCSSM Students	Student Sustainability Advisory Group

See Section 5, Goals and Measures, for a listing of goals for the Conservation Awareness Team.

2.4 Long-Term Water Efficiency Plan – NCSSM
NCSSM developed a Long-Term Water Efficiency Plan in 2004 to reduce water usage.

2.5 State Energy Office Recommendations
NCSSM will implement any proposed rate change recommendations from the State Energy Office after the recommendations are provided.

2.6 HVAC - Chiller Repairs and Renovations Project
The HVAC - Chiller repairs and renovations project to add a new chiller was completed in 2007 and provided more efficient HVAC services since an inefficient 20+ year old chiller was replaced. An investigation was completed during 2004-05 that recommended building a closed loop chilled water system at NCSSM, which will provide cooling to all parts of the campus even if one chiller is not working. The closed loop portion of the project was completed in fall of 2008.

2.7 Steam Leak Repair
Numerous underground steam leaks were repaired in June 2013 and reflected a reduction in gas and water usage for 2014.

2.8 Performance Contract – Lighting Upgrades
The lighting upgrade performance contract was completed in 2016. This project replaced existing lighting with energy efficient LED lighting.

2.9 Guaranteed Energy Savings Performance Contract. During 2017 – 2018, NCSSM negotiated a performance contract. This project was completed in early 2019-20. This project includes water savings opportunities, LED lighting for gymnasium and parking lots, new cooling tower, and HVAC controls. This performance contract is projected to have an energy savings of $4,500,000 over the first 15 years

3. Savings Opportunity Assessment
The combination of the planned actions and projects, and activities in Sections 2 and 3 will help NCSSM achieve its goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 29% student equivalents, 34% staff, and 5.0% square feet since the base year of 2002-03.

3.1 FCAP Operation and Maintenance Energy Survey Recommendations
NCSSM is continuing to implement the recommendations of the Operations and Maintenance Energy Survey. The recommendations included HVAC and Lighting-related issues.

1. Modify Thermostat Settings. In response to the survey recommendations, NCSSM adjusted the thermostat settings and reset the thermostats at the beginning of each year when the students return for the school year.

2. <u>Deduct Sewer Costs for Cooling Tower Make-Up Water.</u> Included in the guaranteed energy savings performance contract was to install metering that will allow the school to deduct the sewer cost for water make up to the cooling towers for the main and Hunt chillers.

3. <u>Turn Off Lights in Unoccupied Rooms.</u> NCSSM will continue its efforts to have the lights turned off in unoccupied rooms. Occupancy sensors for classrooms and conference rooms are included in the system-wide lighting performance contract.

4. <u>Convert Incandescent Lighting to Compact Fluorescent.</u> NCSSM will continue to install compact fluorescent lights as funds permit. **Complete**: Incandescent lighting has been replaced with compact fluorescent or LED lighting throughout the campus.

5. <u>Replace Royall Heat Recovery Wheel.</u> This will use the building exhaust air to condition the fresh air intake before sending it to the coils. **Complete**

6. <u>Reduce Boiler Operating Pressures.</u> Reduce the operating pressures of the boilers to reduce the natural gas usage. - **Complete**

4. <u>Financial Assessment</u>

NCSSM has delayed using its Repairs and Renovations projects to fund energy-related conservation projects since the primary focus has been on student safety for Electronic Access Upgrades Phase I and Phase II, and Sprinklers in Residence Halls Phase I and Phase II. See Section 6, Budgets, for a listing of various current and planned projects. NCSSM is considering the Performance Contracting as an additional option to fund energy-related projects. As a small under-funded educational institution, NCSSM does not have reserves to pay for unforeseen utility or other maintenance and repair projects. The UNC System lighting performance contract was an excellent approach that met NCSSM's needs. The school completed a guaranteed energy savings performance contract in early 2019-2020. This contract is projected to have an energy savings of $4,500,000 over the first 15 years.is also negotiating a performance contract.

5. <u>Goals and Measures</u>

NCSSM has an overall goal to reduce the annual Total Energy Consumption while considering the impact of a growth of 29% student equivalents, 34% staff, and 5.0% square feet since the base year of 2002-03. The goal will reflect the impact of conservation activities, enrollment growth of NCSSM's students, additional square feet of new plant facilities, and added staff members.

5.1 <u>Key Performance Indicators (KPI)</u>

The tracking measures will be used to develop and compare the results for the following State Key Performance Indicators (KPI):

- Total Utilities Cost per Square Foot
- Total Utilities Cost per Student Equivalent

- Electric KWH Use per Square Foot
- Electric KWH Use per Staff-Student Equivalent
- Total Gallons Water per Square Foot
- Total Gallons Water per Staff-Student Equivalent
- Gas Btu Use per Square Foot
- Gas Btu Use per Staff-Student Equivalent

It is critical to note that due to the recent budget shortfall situations, NCSSM was forced to carryover its electrical utility costs for June 2003 into 2003-04 to be paid. The forced reversion continued to cause significant hardships to NCSSM and has made it difficult to compare annual energy costs between years.

5.2 Conservation Awareness Team

NCSSM has established the goals and specific items listed below for the Conservation Awareness Team to encourage acceptance from the NCSSM community. Since NCSSM's 680 students are high school juniors and seniors in a residential program, it will include specific difficulties in getting teenagers to accept and follow utility savings measures. It is difficult enough for families to get teenagers in their home to make utility conservation measures, much less when the students are in a residential setting of 680 students.

1. Students and staff will be encouraged to turn off lights and equipment, other than computers, when leaving a room.
2. Turn off all lights and unnecessary equipment at the end of the day.
3. Monitor management software has been installed on NCSSM's computers by the Information Technology Services Department.
4. Vending machines were de-lamped in the Fall 2002 to reduce utility usage of vending machines.
5. Incandescent and compact fluorescent lighting have been replaced with energy efficient LED lights throughout the campus. This was done through the system-wide lighting performance contract.
6. The Guaranteed Energy Savings Performance Contract was completed in early 2019 – 2020. This project replaced parking lot lights and gymnasium lighting with LED as well as replacing HVAC controls. It is projected to have an energy savings of $4,500,000 over the first 15 years.

5.3 Sustainability Advisory Group

During 2012, NCSSM formed a Sustainability Advisory Group. This group consists of NCSSM administrators, faculty, staff, and students. The main functions of this group are:

1. Create awareness
2. Coordinate sustainability-related activities on campus
3. Develop measures for success
4. Determine measures to disseminate NCSSM's progress

The student led groups, Accept the Greener Challenge (AGC) and Sustainability Project Leaders (SPL) are a part of the group. Some of the activities include

- Publicity and educational awareness
- Construction of a rain garden
- Develop goals for composting and recycling
- Sustainability Cup – energy conservation contest between residence halls
- Greener Unitiative Challenge – year long competition in 3 categories (research, awareness, and outreach)

6. Budget

NCSSM has completed its two projects funded by the Higher Education Bond Program. Both the Royall Center (fully operational in 2003-04) and the Bryan Center (completed in July 27, 2004) included energy conservation design features in the $5.2 million projects. The projects resulted in a more effective use of energy since the Bryan Center converted the Physics area to the central HVAC system for cooling. Previously, the areas had either window air conditioning units or no air conditioning for the Physics Department. It was the only academic area on NCSSM's campus that had not been renovated since NCSSM opened in 1980. Project effort in 2009-10 was student safety; therefore, less spending was on utility projects than in previous years.

2011 – 2012 R&R funds, which were received in December 2012, allocated funds to repair underground steam leaks. Some of the small underground leaks were located and repaired in December 2012. The major leaks were located and repaired in June 2013. The repairs of these steam leaks resulted in a savings in natural gas for 2013- 2014.

2013 – 2014 R&R funds allocated funds for the construction of the new Fab Lab which is equipped with new energy efficient HVAC units. Funds were also allocated to maintain equipment and infrastructure, tune the main boilers, and clean chiller evaporator tubes which help provide for more energy efficient operation.

2014 – 2015 R&R funds allocated funds for the renovation of Engineering and Robotics which improved the controls for the HVAC units. Funds were also allocated to maintain equipment which will provide for more energy efficient operation.

2015 2016 The system-wide lighting performance contract was completed. This contract replaced incandescent and compact fluorescent lighting with energy efficient LED lighting.

2016 – 2017, Grant funds were obtained to install solar panels at the sustainability garden. These efforts will help reduce energy usage.

2018 – 2019 Construction will begin on the guaranteed energy savings performance contract. This project is expected to save $4,500,000 during the life of the loan.

2019 – 2020 The guaranteed energy savings performance contract was completed in early 2019-2020 and the school is expecting to begin receiving the savings. Energy saving features will be incorporated in the design and construction of the NCSSM Western Campus.

2020 – 2021 Five fan coil units were replaced with new, more efficient units, as well as energy efficient controls. Steam leaks were also repaired providing additional savings.

7. Planned Future Projects

Energy related projects (if funded) that are included in our Capital and R&R Six Year Plan are as follows:

2021 – 2022 Chiller Replacement at an estimated cost of $3,000,000
2021 – 2022 AHU & Controls Replacement at an estimated cost of $1,500,000
2021 – 2022 Boiler Replacement at an estimated cost of $350,000
2023 – 2024 Window Replacement at an estimated cost of $3,000,000

North Carolina State University (NCSU) Energy Management

2021 Strategic Energy Management Report

9/1/2021

Highlights and Accomplishments

The following are highlights and accomplishments of energy efficiency strategies implemented during fiscal year 2021:

- NC State successfully funded more than $964,000 of campus energy projects that resulted in projected annual savings of $245,000. Multiple projects ranging from whole building lighting upgrades to building controls upgrades were completed through cost-sharing programs with campus partners.

- Through collaboration among business units within the Facilities Division, Energy Management compiled the fiscal year (FY) 2021 Reinvestment Act claim for more than $6 million in energy savings. The Reinvestment Act of 2010, also known as NC House Bill 1292, allows NC institutions to capture a portion of energy and water savings for reinvestment in further conservation projects.

- The in-house Commissioning Team's work continues to improve the efficiency of NC State buildings through mechanical equipment calibrations, sequence adjustments and HVAC schedule implementations. Partnering with Building Maintenance and Operations technicians, the team achieved $2.7 million in savings in fiscal year (FY) 2021.

- NC State's Energy Performance Contracts span 3 utility plants and 14 buildings across campus. Upgrades range from CHP ("CoGeneration") to HVAC systems upgrades. Each project has a guaranteed annual energy savings; when combined, these projects help NC State avoid at least $10.5 million in utility costs per year.

- NC State periodically reviews utility rate schedules from its providers to find opportunities to improve services or reduce costs. Beginning in December 2020, a change from Duke Energy Progress's Large General Service (LGS) to Time-of-Use (LGS-ToU) rate structure at the Sullivan Substation on Central Campus resulted in a cost savings of over $420,000 in purchased electricity as of July 2021.

- Thermal Energy Storage (TES) at the Centennial Campus Utility Plant completed construction in FY 2020. TES stores 3.4 million gallons of chilled water, which is generated during off-peak hours. This helps offset the need to operate electric chillers during peak hours when electricity prices are highest. Since this came online in July 2020, Peak Demand at the Centennial Campus substation has been lower for 10 of the previous 12 months.

- The first phase of the Exterior Lighting LED Conversion project was completed during FY 2021. This phase converted nearly 1,200 existing pole-mounted lights to LED, while also installing over 150 new pole-mounted lights in order to enhance nighttime safety. With this phase completed, NC State’s pole-mounted exterior lighting will be over 50% LED, and the remaining lights will be converted in subsequent phases. Overall the project aims to save over $100,000 annually in electricity costs with the more efficient LED lights.

Key Performance Indicators

NC State tracks year-over-year change as well as change vs. baseline years. Overall performance vs. baseline shows a 37% decrease in Energy Use Intensity (EUI), and a 56% reduction in total water use on campus despite a 53% growth in campus gross square footage.

Between FY 2020 and FY2021, NC State saw modest decreases in total utility and energy costs and a minor reduction in energy consumption in BTU/GSF. Water costs and consumption were considerably lower than previous years, due to reduced campus occupancy as a result of Covid-19.

Table 1 - KPI Summary 2021

Fiscal Year	2001-2002 *	2002-2003	2017-2018	2018-2019	2019-2020	2020-2021	% Change (1 Year)	% Change from Baseline
Utility Cost, $ / GSF		$1.98	$1.85	$1.84	$1.60	$1.51	-6%	-24%
Energy Cost, $ / GSF		$1.87	$1.58	$1.56	$1.34	$1.30	-3%	-31%
Water Cost, $ / GSF	$0.12	$0.11	$0.27	$0.28	$0.26	$0.21	-19%	77%
Energy Consumption, BTU / GSF		171,810	119,144	113,859	108,737	108,079	-1%	-37%
Potable Water Consumption , CCF / GSF	0.066	0.054	0.031	0.033	0.030	0.024	-20%	-64%
Total Water Consumption , CCF / GSF	0.066	0.054	0.035	0.037	0.035	0.029	-16%	-56%
Campus Area, Gross Square Feet (GSF)	9,796,638	9,910,619	14,972,547	14,963,604	14,999,125	15,133,063	0.9%	53%
Heating Degree Days		3,592	3,374	3,151	2,744	3,136	14.3%	-13%
Cooling Degree Days		1,656	2,034	2,052	1,942	1,820	-6.3%	10%

* Baseline year for water cost and consumption per gsf is 2001-2002 per Gov. Easley's EO Number 26. For all other KPIs, the baseline year is 2002-2003.

Table 1 - Key Performance Indicator Summary from 2020-2021

Commitment

The 2017-2022 NC State Sustainability Strategic Plan sets forth several goals on the "Pathway to a Sustainable Future." In campus Operations, Planning, and Design, the university committed to the following **energy management goals:**

1. Reduce total campus energy use intensity (EUI) by 40% from the Fiscal Year 2003 baseline.
2. Expand the amount of renewable energy used to meet NC State’s needs.
3. Reduce campus water consumption by 65% from the Fiscal Year 2002 baseline.
4. Contribute to NC State’s total greenhouse gas (GHG) emissions reduction goal by 25% from the 2008 baseline.
5. Collaborate to inform and empower campus community for energy and water savings.

COVID-19

Historically, Facilities' commitment to support NC State and be good stewards of campus energy expenditures has focused on energy reduction and optimization. In 2020 and 2021, "good stewardship" took on a broader context; building ventilation and filtration requirements increased to ensure a safe environment for occupants through the COVID-19 pandemic. In many cases, this ran counter to conventional energy management strategies: longer operational times, larger heating and cooling loads on equipment, and higher rates of conditioning outside air. These necessary actions lessen the capacity of energy saving strategies.

Fiscal year 2021 saw a 1% decrease in campus EUI despite the improved safety protocols.

Energy Management Strategies *(And the Goals to which they apply)*

Strategy A: Optimize building energy use through energy auditing, retro-commissioning, predictive maintenance, control upgrades, incentive programs and occupant education. *(Goals 1, 3, 4, and 5)*

- Tactic A1: Use Building Energy Assessment Tool (BEAT) to compare building performance based on industry building energy standards.
    - Continuous: BEAT update cycle began in August 2021 and will be complete in Oct 2021.
- Tactic A2: Require building envelope commissioning for new capital projects.
    - Some Progress: Design Guidelines for building envelope commissioning are under development. The Plant Sciences Building (scheduled for completion in February 2022) will require envelope commissioning prior to building acceptance.
- Tactic A3: Partner with campus departments to incorporate energy savings into predictive building maintenance procedures.
    - Some progress: Analyzing the use of high efficiency air filters in air handlers. Investigating using UV lights as a more efficient cleaning solution for air handler coils.
- Tactic A4: Upgrade obsolete building controls as necessary.
    - Some progress: Carmichael Recreation Center was upgraded in FY 2021.
- Tactic A5: Promote the Ultra Low Temperature Freezer Rebate Program to replace inefficient freezers with energy efficient ones.
    - Continuous: In FY 2021, 9 freezers were replaced with high efficiency models.

Strategy B: Reduce energy use in NC State's five central utility plants by 5% from 2015 baseline. (Goals 1, 3, and 4)

- Tactic B1: Install variable frequency drives (VFDs) on utility plant pumps.
    - Some progress: VFDs will be installed on 2 chilled water and 1 condenser water pumps at Cates and Yarbrough Utility Plants in FY 2022.
- Tactic B2: Recommission the utility plants to optimize energy production.
    - Some progress: Recommissioning report was conducted in FY21 for Yarbrough Utility Plant. Energy conservation measures (ECM) will be implemented in FY22.
- Tactic B3: Conduct steam trap surveys to identify failed traps for replacement.
    - Continuous: Annual steam trap survey and repair in utility plants and distribution tunnels.
- Tactic B4: Conduct boiler tune-ups.
    - Continuous: Tune-ups are performed annually on all utility plant boilers to ensure optimal operation.

Strategy C: Explore and develop best practices for smart infrastructure and energy generation use in campus buildings. *(Goals 1, 2, 3, 4, and 5)*

- Tactic C1: Conduct solar and battery storage feasibility study for multiple campuses.
    - Complete: Studies for Centennial Campus were completed showing potential cost and greenhouse gas reductions.
- Tactic C2: Incorporate chilled water Thermal Energy Storage (TES) at the Centennial Campus Utility Plant
    - Complete: TES tank is operational. Dispatch optimization is being studied.
- Tactic C3: Integrate building utility meters to provide accurate, real-time data.
    - In progress: 16 utility meters were installed, integrated, or upgraded in FY 2021.

Strategy D: Reduce potable water consumption across all campuses. *(Goals 3 and 4).*

- Tactic D1: Employ reuse (reclaimed or non-potable) water for toilets, irrigation, etc. on Centennial Campus
    - Some progress: Fitts-Woolard Hall uses reuse water for irrigation and domestic sanitation, and the same is planned for the new Plant Sciences Building.
    - Complete: Centennial Campus Utility Plant uses reuse water for cooling tower make-up.
- Tactic D2: Reduce potable water use in campus buildings and utility plants. Assess novel and proven technologies to guide efforts.
    - Complete: Jordan Hall cooling tower replacement to reduce the amount of water loss due to tower degradation.
    - In progress: Project is underway to reroute water previously sent to the drain for use as boiler makeup water.
    - On Hold: Partnership with NC State Stewards to equip student volunteers with tools to test bathroom faucet flow rates and replace with low flow faucet aerators as needed in academic buildings. The COVID-19 pandemic put this on hold and is expected to resume in FY 2022.

Energy Management Team

Name	Role	Signature	Date
Allen Boyette	Senior Director - Energy Systems		
Damian Lallathin	Director of Energy Management		
Rebecca Diederich	Energy Project Engineer		
Matthew Duffy	Energy Data Systems Administrator		
Lib Reid McGowan	Energy Data Analyst		
Vincent Potter	Energy Project Manager		
Kerby Smithson	Energy Project Manager		

Costs of Analysis

NC State collects electric usage data from 100% of its buildings and thermal utility usage data from approximately 80% of its buildings. NC State has developed a tool to calculate building EUI and compare that performance to ASHRAE 100-2015 EUI benchmarks. The resulting output is weighted based on annual cost of operation to identify targets for investigation and remediation.

Internal costs are attributed to analysis and investigation performed by campus energy engineers. This upcoming year, in addition to the recommissioning efforts, we plan to begin constructing an in-house energy auditing program. In some occasions, analysis is outsourced to specialist consulting groups and these projects along with estimated costs are depicted in the table below.

Fiscal Year	Projects	Cost	Results
2020-2021	Schaub and Terry Center	$45,000	Schaub investigation for ECM opportunities. Terry Center additional air barrier and balancing remediation.
2021-2022	TBD, Peele, Terry Center	$60,000	Buildings prioritized from the BEAT. Peele project scoping. Terry Center continued air barrier analysis and remediation.

Appendix A: Performance

Energy

Campus energy consumption peaked in fiscal year 2009 and has trended downward since. A combination of unusually mild weather and uneven fuel oil purchases contributed to the apparent uptick in fiscal years 2017 and 2018. Compared to the fiscal year 2003 baseline, total energy consumption per gross square foot (GSF) has decreased by 37% in fiscal year 2021 (see Figure 1).

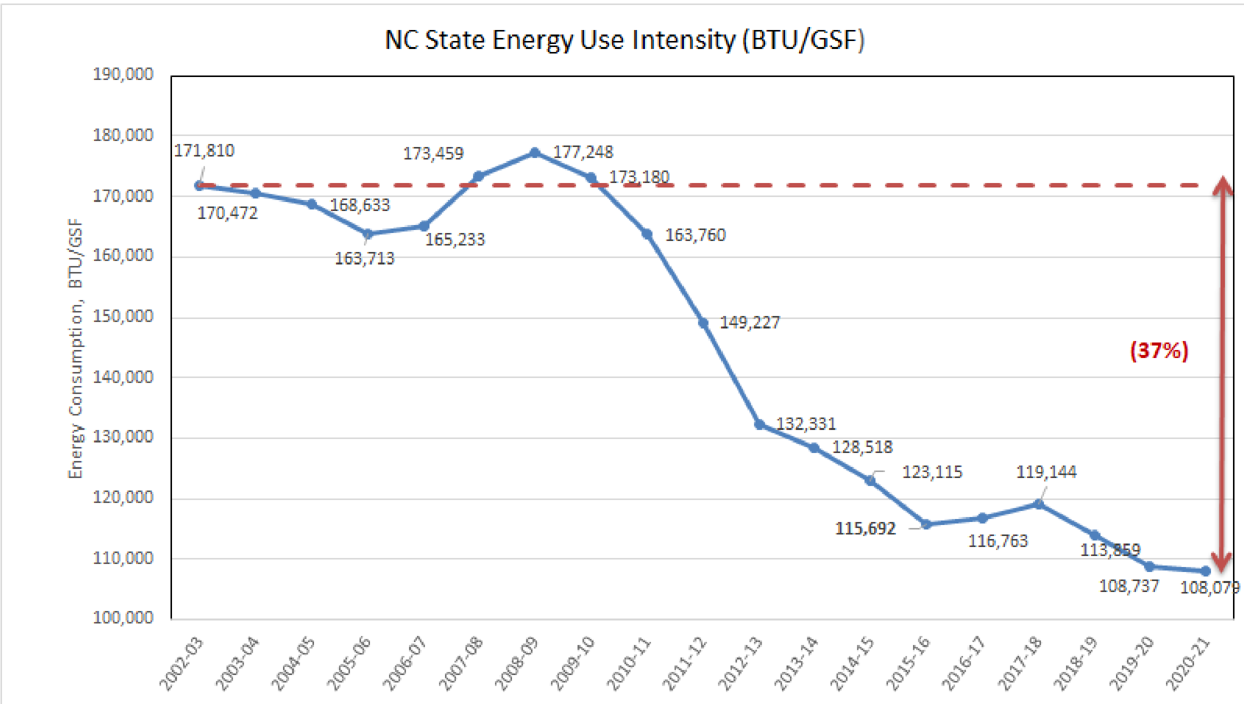


Figure 1- Energy Use Intensity (BTU/GSF)

*Combined Heat and Power Adjustment Methodology: NC State purchases electricity, natural gas, fuel oil, and potable and reuse water from third parties. Electricity is also generated on campus using an 11 megawatt (MW) CHP system. As a result of CHP, fuel use for on-site power generation increases, fuel use for boilers decreases, and grid electricity purchases (or source energy) decreases.

The methodology for reporting the benefits garnered through the operation of CHP follows the U.S Department of Energy measurement protocol outlined by the Federal Energy Management Program in the Reporting Guidance for Federal Agency Annual Report on Energy Management issued October 2018. The purpose of the adjustment is to not penalize organizations under the site energy based performance metric for implementing cost-effective projects where source energy decreases but site-delivered energy increases.

Water

In fiscal year 2016, NC State began utilizing non-potable reuse water supplied by the City of Raleigh on Centennial Campus. Reuse water is wastewater treated to a high standard and reused instead of being discharged into a waterway. Reuse water provides a more cost-effective and drought resistant supply of water for cooling towers, irrigation and toilet flushing. For total water consumption (potable and reuse), fiscal year 2021 marked a level 56% below the FY 2002 baseline and potable water consumption decreased by 64% (see Figure 2). This can be partially attributed to lower campus occupancy due to COVID-19 operating restrictions.

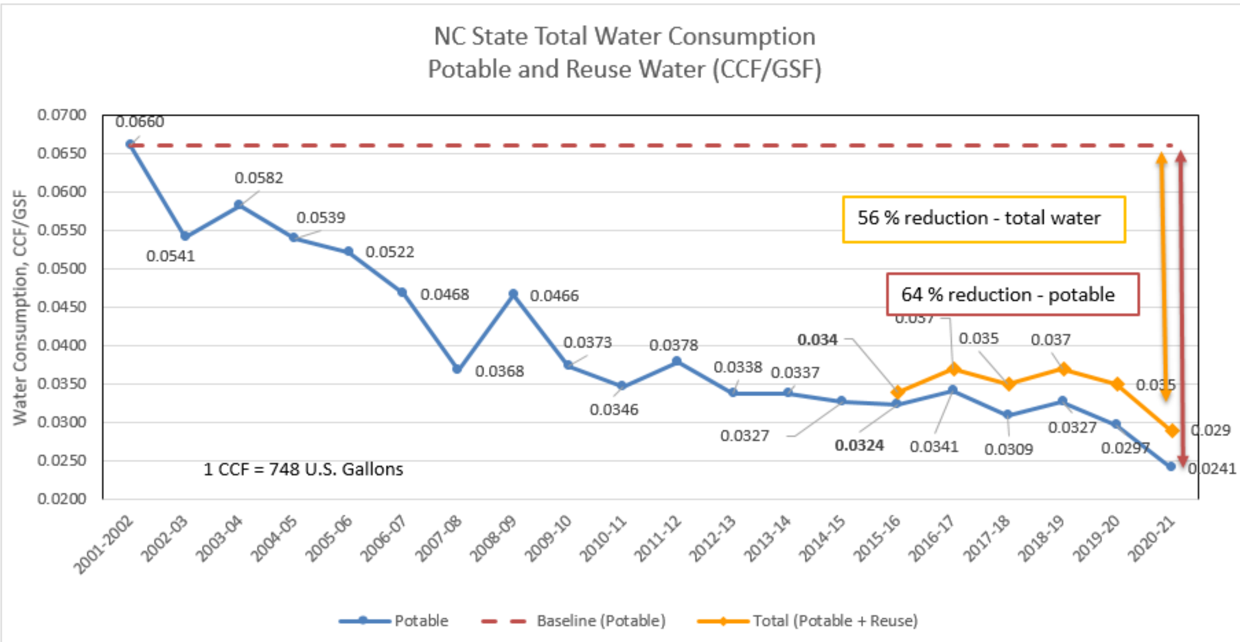
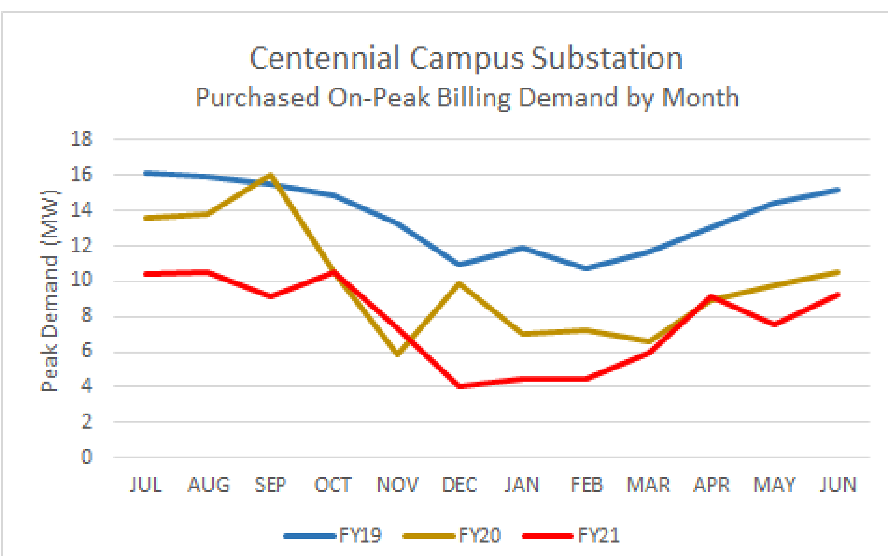


Figure 2- Water Consumption per GSF



Thermal Energy Storage

Figure 3 shows the peak demand at the Centennial Campus Substation. The Red line is the most recent Fiscal Year. CHP began at the Centennial Utility Plant in Feb 2019, and Thermal Energy Storage started in July 2020, further reducing peak electric demands.

Figure 3 - Centennial Demand by Month

Overall Progress

Total Utility Cost per GSF has held relatively steady over the past four years due to efforts in conservation, generation, and strategic procurement. For fiscal year 2021 the Total Utility Cost per GSF is $1.51/GSF, which is 23% lower than the 2002-2003 baseline. This is despite energy prices that have increased by 10% and water prices that have increased by 346% since fiscal year 2003. Energy and water efficiency gains, coupled with low natural gas prices and Energy Management's strategic purchasing of natural gas, have all contributed to the gradual reduction in Total Utility Cost per GSF. An electric rate change at Sullivan Substation (serving Central and North Campus) from LGS to LGS-TOU this year is responsible for approximately 2.8 cents per GSF of this reduction.

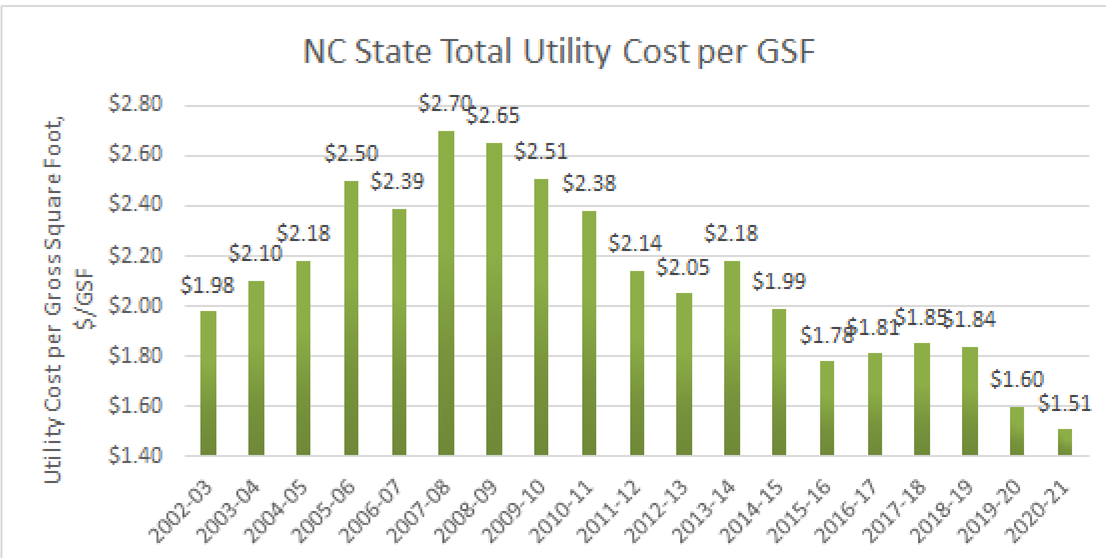


Figure 4- Utility Cost per GSF

Growth vs. Performance

Figure 4 illustrates the university's growth and total energy consumption over time. As indicated by this figure, the university continues to make significant progress in reducing its Energy Use Intensity through energy efficiency strategies and efforts by the campus community (see page 4).

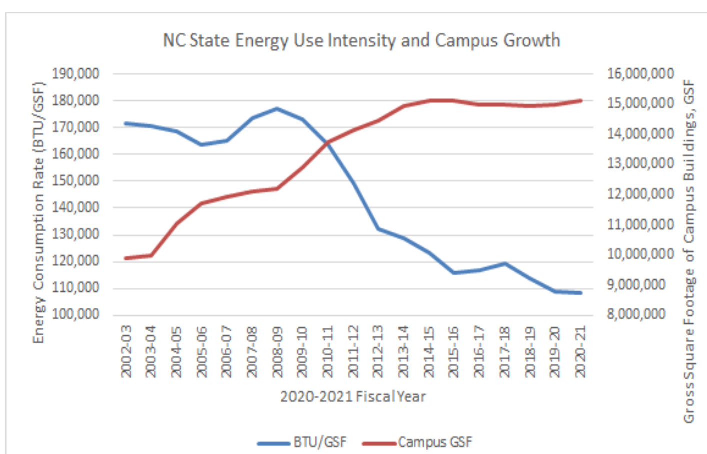


Figure 5- Energy Use Intensity and Campus Growth

Each year, NC State typically purchases approximately $30 million in utilities. During fiscal year 2021, electricity accounted for more than half of our utility purchase total. Electricity is the utility most influenced by the campus community and, as such, has the greatest potential for reduction through conservation actions by individuals such as turning off lights, unplugging electronics not in use, closing windows and doors, shutting fume hood sashes in labs and turning off computers not in use.

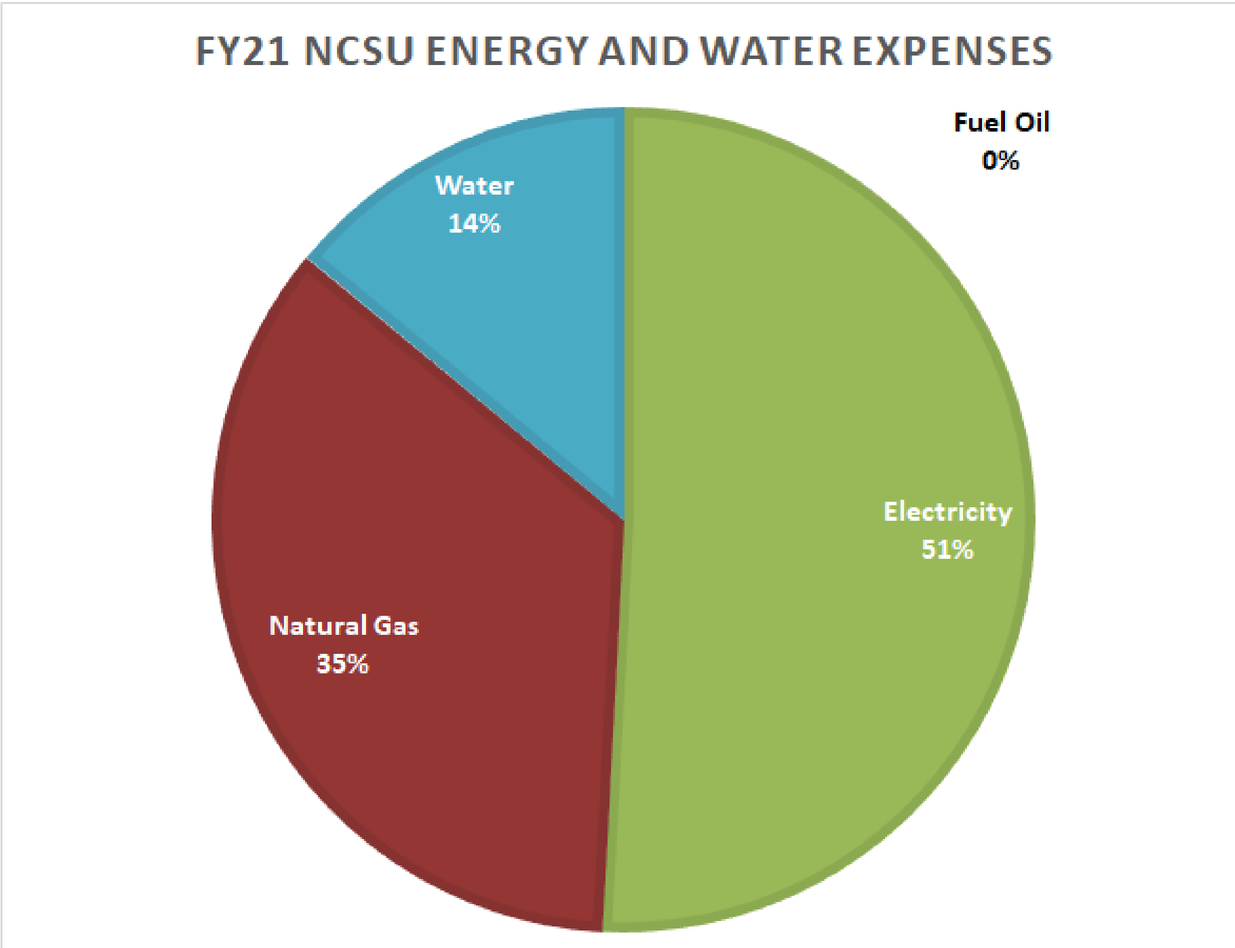


Figure 6 - Energy and Water Expenses FY 2021

Appendix B: Projects

Fiscal Year 2021 Projects			
Project and Location	**Project Cost**	**Est. Avoided Cost (Annual)**	**Simple Payback (Years)**
Holiday Energy Savings Initiative (Expanded due to COViD)	$20,000	$875,000	0
Main Campus Exterior LED - Phase I Partnership with Capital Projects	$2 million	$100,000	20
CVM Chilled Water Reductions- Correct Low Temperature Differential	$151,000	$53,700	2.8
Building VFD Replacements - Burlington Labs, BTEC	$12,300	$36,000	.3
Carmichael Rec - Controls Upgrade	$105,000	$32,000	3.5
Building Audits: Envelope Study - Schaub Hall, Terry Vet Center	$90,000	$30,000	3
Jordan Hall - Cooling Tower Replacement	$78,000	$12,000	6.5
ULT Freezer Rebate Program - Academic Departments	$35,000	$5,000	7
Schaub Hall: Howling Cow Case Washer Replacements	$4,000	$2,750	1.5
Fume Hood Removal - Biltmore	$3,000	$1,500	2
Dabney - AHU 1 Coil Cleaning	$4,000	$1,500	4

Fiscal Year 2022 Projects - Expected			
Project and Location	**Project Cost**	**Est. Avoided Cost (Annual)**	**Simple Payback (Years)**
Holiday Energy Savings Initiative	$20,000	$380,000	0
Recommissioning - Holmes Hall, Schaub, others TBD	$250,000	$150,000	2
Recommissioning - Yarbrough Utility Plant	$50,000	$40,000	1.5
Duct Sealing - Engineering Building 2	$70,000	$40,000	2
Chiller Pump VFD Upgrades - Cates and Yarbrough Utility Plants	$200,000	$40,000	5
Building Audits: Peele Hall, West Research Annex, TBD	$40,000	$15,000	3
Fume Hood Removal - Partners 2, Partners 3, Engineering Building 3, Textiles	$25,000	$10,000	2.5
ULT Freezer Rebate Program - Academic Departments	$50,000	$10,000	5
Whole Building LED - Centennial Campus Utility Plant	$130,000	$10,000	13
Events2HVAC Expansion: Textiles, 111 Lampe, Withers, 1911, Leazar, Schaub, Park Alumni Center	$11,000	$7,500	1.5
Surface Water Condenser Reuse - Centennial Campus Utility Plant	$5,000	$5,000	1

Appendix C: Energy Performance Contracts

EPC Information	Description
Cogeneration on North and Central Campus (2012) - 17-year contract, $56.1 million invested. Cates Plant on Main Campus	In 2012, this project replaced aging boilers in both the Cates and Yarbrough Central Utility Plants with new high efficiency boilers and a cogeneration system. The cogeneration system, or "combined heat and power," utilizes natural gas to produce 11 MW of electricity while the waste heat from the process produces steam. Utility savings are realized due to a reduction in the total cost of electricity and steam production through increased efficiency. In addition, the new system is expected to reduce campus greenhouse gas emissions by 8% (approximately 33,000 MT CO_2e). Guaranteed savings for this year are over $6.4 million.
Centennial Campus Cogeneration (2019) - 18-year contract, $17 million investment CCUP on Centennial Campus	The Centennial Cogeneration EPC removed a boiler in the Centennial Central Utility Plant and installed a high efficiency cogeneration system. The cogeneration system includes a combustion turbine generator (CTG) which generates 5.5 MW of electricity, and a steam turbine generator (STG) which is capable of generating an additional 1 MW of electricity from the excess steam. Utility savings are realized due to a reduction in the total cost of electricity and steam production through increased efficiency. The new system is projected to also reduce the campus greenhouse gas emissions by about 4% (approximately 16,000 MT CO_2e). CCUP's most recent annual savings exceeded $2 million.
13 Building EPC (2012) - 19-year contract, $19.7 million investment Buildings located on North, Central and Centennial Campuses	The 13 Building EPC encompasses the following buildings: Cox Hall, Poe Hall, Tompkins Hall, Caldwell Hall, Winston Hall, College of Textiles, McKimmon Center, Monteith Research Center, Research I, Dabney Hall, Carmichael Gym, Constructed Facilities Lab and MRC Parking Garage. The EPC included renovations and operational changes with the HVAC systems and fume hood controls, lighting upgrades, water reduction strategies and a solar hot water system in Carmichael Gym. The most recent annual savings exceeded $2 million.
Phytotron EPC (2014) - 15-year contract, $6.2 million investment Located on North Campus	Constructed in 1968, the Phytotron Building performs plant, animal and insect research by simulating environments from desert heat and drought to Alpine cold and jungle humidity. The Phytoron EPC addressed HVAC and lighting upgrades, as well as a connection to the central chilled water loop and research equipment improvements. Phytotron's most recent annual savings were over $690,000.

Appendix D: Renewable Energy Implementation

Solar and Storage Options

NC State's Department of Civil, Construction, and Environmental Engineering prepared a study on the university's options for campus solar and storage deployment. The report studied applications across all three campuses in Raleigh, NC.

The report found that conditions on Centennial and Centennial Biomedical Campuses were more favorable to solar and/or storage than North and CentralCampuses. This is largely due to the electric rate structure allowing additional savings from Time-of-Use (TOU) peak reductions or solar generation. However, since the report, the utility rate structure on North and Central Campuses has switched to TOU as well. This makes all three campuses favorable.

On the Centennial Biomedical Campus, there are several proposed solar projects, handled by NC State Athletics. In January 2021, Powerhome Solar installed a PV array on NC State Athletics' Murphy Center.

On Centennial Campus, NC State has schematic designs and secured funding for the installation of an approximately 182kW solar array on the rooftop of the recently completed Fitts-Woolard building. NC State is also planning for battery storage on this campus and has a 500kW battery installation in development.

NC State Solar and Storage Projects			
Location	**Description**	**Est. Cost**	**Est. Annual Savings**
Fitts-Woolard Hall	182kW_{DC} Solar PV	\$500,000	\$23,800
Centennial Campus	500kW 2hr Battery	\$431,000	\$85,400

UNC CHARLOTTE

Strategic

Energy Plan

2021 UPDATE

September, 2021

Contents

Strategic Energy Plan

Executive Summary

Campus Energy Overview

Size and Growth

UNC Charlotte is an urban research-intensive university, located primarily on a 1,000-acre campus in the state's largest city. In the Summer of 2021, the University had a campus community (students, faculty, and staff) of approximately 33,300 with nearly ten (9.97) million gross square feet (GSF) of built space, including parking decks. Plans continue for an enrollment increase to approximately 35,000 students in the next (5) years. Additional Academic / Research, Auxiliary Services and Residence Life space continue to be built to support campus population growth.

Since 2003, the full time equivalent (FTE) Faculty / Staff campus population has grown to 3,700 and built space has more than doubled. In that same period, energy consumption has grown by 45%, and energy costs have grown by 75%; however, energy consumption per GSF has fallen by 38%. Although, the university strives to reduce energy consumption in campus facilities 2021 may not be indicative of actual performance do to operation changes associated with COVID-19.

Energy Systems

Building heating and cooling requirements are provided by a combination of Regional Utility Plants (RUPs) and HVAC systems dedicated to specific buildings. Regional Utility Plants are designed and constructed to provide energy efficient distribution of chilled water and hot water to multiple buildings. The conversion from steam heat is nearly complete. Small steam boilers are still in use in 2 buildings. The new RUP5 is now up and running, supporting the core campus buildings that used the Main Plant Steam.

The majority of main campus is primarily served by a single electrical substation. Given the emerging potential for energy conservation, the university may be able to meet future growth with its current electrical substation, thus saving substantial infrastructure costs and land. One emerging challenge could be to meet electricity demand if electrification of current natural gas-fueled equipment is pursued to meet climate goals and/or required in modernized building codes.

Energy Conservation Challenges, Accomplishments and Goals

Accomplishments and Goals

UNC Charlotte's energy use reduction of 38% per building GSF provided an avoided cost of approximately $5.5 million this year alone over the 2003 baseline. New buildings continue to have energy recovery and high efficiency equipment / systems installed. As noted previously these results may not be indicative of actual performance due to operational changes to facilities associated with COVID-19.

Funded through a combination of Performance Contracting, Operational and Repair and Renovation funds, significant energy reduction will continue through:

- ASHRAE Level II Energy Audits
- Tuning of buildings to actual requirements versus design assumptions
- System retrofit modifications such as high efficiency motors, VFDs, LED lighting
- HVAC scheduling for occupancy
- Awareness training

The University is now in Year 7 of its "Guaranteed Energy Savings Performance Contract" w/ Year 6 M&V verifying $66,048 and Year 7 M&V non-verified $64,981 in excess savings. The "Performance Contracts" through Ameresco and JCI (UNC – Gen. Admin. Lighting) continue to provide energy savings through the energy related capital improvements to roughly twenty-eight (28) different campus facilities.

Web based monitoring continues to be provided on all new buildings and on existing buildings undergoing major renovations. State-of-the-art DDC Control Systems with utility monitoring and trending are also used.

Retro-Commissioning and building energy audits continue to be a priority as funding becomes available. Retro-Commissioning will be prioritized at the RUP facilities and will be performed at other facilities only after ASHRAE Level II energy audits have been completed on the facility.

The University continues to add utility monitoring to existing buildings that do not have active water, electricity, chilled or hot water BTU meters and natural gas pulse units. Older meters are being replaced with new meters that have the capability to communicate to the existing Building Automation System (BAS), which allows trending and archiving of energy usage data. Keeping the BAS and existing energy meters on campus operational and properly communicating is an ever increasing (on-going) challenge as well.

North Carolina G.S. 143-64.12 and LEED principles for sustainability, particularly relating to energy and water use, are included in the UNC Charlotte Design and Construction Manual. UNC Charlotte has (10) certified green buildings to date (5 LEED, 5 Green Globes) and is currently pursuing Green Globes certification for the new Science Building and Phase XVI Housing . Since the first campus building was certified under LEED in 2009, UNC Charlotte has certified construction and design on 71% of eligible construction based on occupied gross square feet. With smaller buildings that are not certified, the university continues to emphasize energy and water efficiency standards detailed in the Design and Construction Manual. Updates to the manual were formally adopted in 2018-19 in areas of lighting, lighting controls, insulation, solar thermal heating systems, plumbing fixtures and construction/demolition waste diversion to align with ASHRAE 189.1 (2014) *Standard for the Design of High-Performance Buildings* and ASHRAE 90.1 (2016) *Energy Standard for Buildings*. Starting in 2020, the university has maintained a Gold-level membership in the US Green Building Council to make over 900 online courses available free to staff, faculty and students.

To gain an external comparison, UNC Charlotte participated in the USEPA Energy Star Higher Education Benchmarking Initiative. Energy data for the Main Campus for calendar year 2019 was submitted to EPA. A scorecard report was generated by EPA to compare UNC Charlotte to different institutional peer groups (from 187 participating campuses) in terms of energy use intensity (EUI). UNC Charlotte Main Campus EUI ranked: 60 out of 67 for campuses with central heating plants; 14 of 18 for campuses with 50-99 buildings; 21 of 25 for campuses with 7-12% Energy Intensive floor space; 18 of 20 for campuses in Climate Zone 3; 12 of 19 for campuses with 20-29% resident students; 20 of 24 for campuses with $90M-$700M endowments; and 3 of 4 for Carnegie classification Doctoral/Professional. In summary, UNC Charlotte's Main Campus EUI was higher than the median in every comparison group the EPA could assemble. This report challenges us to consider whether university and state standards, goals, and investments for energy conservation are too modest.

Water Systems Management

Since 2003, water utilization (gallons per square foot of buildings) has been reduced by 54%. The large growth of facilities and population since 2003 has only resulted in consumption growth of 8%. However, water plus sewer combined costs per gallon since 2003 have increased by 186% and thus water plus sewer spending has grown by 210%. Although, the university strives to reduce water consumption in campus facilities 2021 may not be indicative of actual performance do to operation changes associated with COVID-19, with previous years showing water utilization at ca. -45% and total water consumption at ca. +25% compared to our 2003 baseline.

There are four (4) distinct water systems associated with the UNC Charlotte campus. Those systems are 1) Potable Water, 2) Reclaimed Water (in development), 3) Sanitary Sewer, and 4) Stormwater.

Charlotte Water started construction in 2021 on a new sanitary sewer collection main which runs through the middle of the University's Campus. The new 42" sanitary sewer pipe will parallel Toby Creek replacing some of the Campus' existing 24" sewer collector main. Charlotte Water is also installing a 16" Reclaimed Water transmission line parallel to the new sanitary sewer.

UNC Charlotte has finished design of the Reclaimed Water infrastructure system and sent the plans out for bid. Construction is anticipated to be completed by the end of 2022. This infrastructure will connect to Charlotte Water's 16" transmission line. The reclaimed water will replace approximately 20% of the potable water currently used on campus, at a greatly reduced price per gallon. The Reclaimed Water will be used for cooling tower make-up water and irrigation water. The reclaimed water will be supplied from Charlotte Water's Mallard Creek Water Reclamation Facility near the Campus.

Energy Plan

UNC Charlotte's energy plan is structured into five 5 areas in order to accomplish specific goals in each of the categories below.

Energy Data Management – UNC Charlotte has a program for collecting and analyzing monthly utility billing information using spreadsheets. The main campus electrical substation is trended real-time to document high consumption periods. UNC Charlotte is beginning to compare energy usage in similar building types by usage, i.e. library, classroom building, research building, etc.

Energy Supply Management – UNC Charlotte is proactive in selection of electrical rates and cost-effective fuel rates for Regional Utility Plants. Energy supply management must also demonstrate choices that achieve the campus and UNC System goals to be carbon neutral by 2050, the state goal of 40% reduction in greenhouse gas emissions by 2025, and the City of Charlotte's Strategic Energy Plan for reducing greenhouse gas emissions per capita by 80% by 2050. Facilities Management thoroughly reviews utility invoices for deviations indicating billing errors.

Energy Use in Facilities – Building HVAC and lighting controls are updated as renovations occur or as Retro-Commissioning takes place. New buildings have state-of-the-art Building Automation System (BAS) controls. New and existing building control systems will be evaluated and adjusted for optimum energy usage.

Equipment Efficiency – UNC Charlotte requires all equipment replacements to meet or exceed code requirements. Preventive Maintenance is in effect. Major energy consuming equipment will be identified and evaluated for cost-effective modification or replacement. All chillers were selected on Life Cycle Cost Analysis.

The Utility Carry Forward funds have historically been used for Retro-Cx of campus buildings and fixing small equipment issues found by the Retro-Cx to improve the building energy efficiency. Larger and more capital intense equipment is normally funded through R&R capital projects. In FY-22, the Utility Carry Forwards funds are expected to fund ASHRAE Level II Energy Audits on campus and fixing energy issues found by these audits.

Organization Integration & Awareness Training – The Energy Manager will continue to work closely with the University Sustainability Officer for various energy conservation measures and training efforts within the appropriate University departments. The Sustainability Office priorities as of 2018 are to pursue compliance with the UNC Sustainability Policy (600.6.1). Energy management is recognized in the sustainability plan as under a category of "Operational Priority" with an expectation for continuous improvement. The Energy Manager will also contribute to a 5-year initiative on "Responsible Purchasing" that includes improving policies and practices regarding procurement of energy and technologies. In response to Sustainability being apart of the Chancellors strategic plan the Chancellor's Executive Sustainability Committee is drafting a Sustainable Facilities Policy that may include building standards, temperature policy, and purchasing of energy and water consuming equipment. These efforts are aimed at improving behavior and awareness in ways that contribute to the University's continued ability to exceed the state of North Carolina mandated conservation goals.

Strategic Energy Plan

Past Year Accomplishments	Measurement	Savings Estimated	Cost	Funding Source	Area
Maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Monitored all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM Budget	Energy Data Management
Continued firm & interruptible transportation of nat. gas w/ well head pricing for RUP's.	$ per month	$234k	N/A	FM Budget	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM Budget	Energy Supply Management
Reviewed Duke Energy GreenSource Advantage PPA offering to determine renewable energy procurement enabled by HB589	kWh	N/A	N/A	FM Budget	Energy Supply Management
ASHRAE Level II Energy Audits conducted by FM in conjunction with university faculty at five (5) university buildings. Savings noted is identified.	kWh, Therms	$170k	$47k	Utility Carry Forward	Energy Use in Facilities
Implemented five (5) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$116k	$114k	Utility Carry Forward / FM	Energy Use in Facilities
Replaced 4 ultralow freezers in Dept. of Biol. Sci.	kWh	$1.25k	$40,700	Student green fund	Organization Integration & Awareness Training
Stormwater Master Plan	Final Report	N/A	$300k	FM Budget	Organization Integration & Awareness Training

Strategic Energy Plan

Planned Activities 2021-2022	Measurement	Savings Estimated	Cost	Funding Source	Area
Continue maintenance on the existing submetering infrastructure and expand where needed.	Monthly	N/A	$86k	Utilities Carry forward	Energy Data Management
Continue to monitor all utility bills for billing errors and miscalculations by major utilities.	$ per month	N/A	N/A	FM	Energy Data Management
Continue firm & interruptible transportation of nat. gas w/ well head pricing for RUP’s.	$ per month	$234k	N/A	FM	Energy Supply Management
Reviewed rate schedules with DEC and PNG to assure the University is on the most favorable rate sch.	kWh /therms	N/A	N/A	FM	Energy Supply Management
ASHRAE Level II Energy Audits will be conducted by FM in conjunction with university faculty at ten (10) university buildings.	kWh, Therms	TBD	$47k	Utility Carry Forward	Energy Use in Facilities
Implement ten (10) findings from the ASHRAE Level II Energy Audits conducted.	kWh, Therms	$96k	$104k	Utility Carry Forward / FM	Energy Use in Facilities
Develop/Implement HW/CHW optimization Strategy	Develop/ Implement in 15 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
Implement Economizer Control, Supply Air Temp, & Demand Based Reset Strategies	Implement in 15 Buildings	TBD	TBD	Utility Carry Forward / FM	Energy Use in Facilities
McEniry Hall Chiller Replacement	kWh	TBD	TBD	FM	Equipment Efficiency
Student Health Center AHU Replacement	kWh, Therms	TBD	TBD	Health Services	Equipment Efficiency
Develop Energy Efficiency Goals for BAS technicians & Train to Identify	kWh, Therms	TBD	TBD	FM	Organization Integration & Awareness Training
Develop a UNCC FM Energy Management web page.	Web Page Developed	N/A	N/A	FM	Organization Integration & Awareness Training
Finalize New Temperature Control Policy and implement with Administrative Facilities	Implement	TBD	TBD	FM	Organization Integration & Awareness Training
Grants to depts for upgrade costs for 6 EnergyStar ultralow freezers for new Science Building	kWh	$18,000	$12,000	Student green fund	Organization Integration & Awareness Training
Reclaimed Water System Water Quality Instrumentation (includes academic access to data)	Sensors purchased	N/A	$35,000	Student green fund	Organization Integration & Awareness Training
Transportation Plan Development (includes parking facility design standards)	Plan adopted	N/A	N/A	Sustainability Budget	Organization Integration & Awareness Training
Re-launch of Green Office Program to expand/update energy conservation tips	Office units certified	N/A	$3,000	Sustainability Budget	Organization Integration & Awareness Training
University Policy for Sustainable Facilities (includes energy and water conservation)	Submission to Chancellor	N/A	N/A	Sustainability Budget	Organization Integration & Awareness Training

Appendices

A. G.S. 143-64.12(a) Declaration

B. SEO Annual Report Form FY ‘21 (Attachment)

UNC Hospitals
Chapel Hill, NC

Strategic Energy and Water Plan

August 2021

Executive Summary

During fiscal year 2020-2021, UNC Hospitals at Chapel Hill, NC continued its commitment towards energy conservation and utility cost avoidance. This past year's primary focus was on monitoring the improvements made through American Energy Assets, LLC which was originally contracted in 2016 to review and improve the facility's utility patterns, system operations, and explore ways to reduce consumption. AEA's initial contract ended at the end of fiscal year 2019, and a maintenance based agreement was entered into in fiscal year 2020 with AEA to prevent savings slippage. The maintenance based agreement expired in July of 2021 and was not renewed due to budget constraints resulting from the pandemic.

UNC Hospitals continues to maintain a program of facility maintenance, improvements, and renovations that has a significant effect on controlling overall energy consumption and costs. As interior building renovations are completed, the latest energy codes are utilized to ensure that the equipment and systems being installed are compliant. In addition, Life Cycle Cost analysis and performance guidelines complying with the State Building Code, the NCAC, and the State Construction Office Construction Manual are utilized to achieve the best cost and energy performance on these projects as applicable.

The following tables summarize UNC Hospitals' energy performance (Table 1), water performance (Table 2), and energy cost avoidance (Table 3) since 2002-2003.

Table 1: Net Energy Performance (Excludes Water, Sewer, Non-potable) Fiscal Year 2002/03 to 2020/21

Fiscal Year	*Total Fiscal Year Energy Cost ($)*	*$/MMBTU*	*$/GSF*	*BTU/SQFT*	*Change in BTU/SQFT (Compared to 2002-2003)*
2002-2003	$8,089,456	$12.74	$4.18	327,754	-
2003-2004	$7,341,105	$11.75	$3.79	322,415	-2%
2004-2005	$8,247,839	$11.22	$4.26	379,383	+16%
2005-2006	$9,943,314	$14.88	$5.13	344,912	+5%
2006-2007	$10,072,484	$16.53	$5.20	314,520	-4%
2007-2008	$11,098,732	$22.16	$5.73	258,574	-21%
2008-2009	$12,369,412	$23.45	$6.39	272,312	-17%
2009-2010	$14,933,832	$24.19	$6.51	269,296	-18%
2010-2011	$15,724,242	$26.07	$6.76	259,123	-21%
2011-2012	$16,301,419	$28.44	$7.00	246,331	-25%
2012-2013	$15,580,123	$26.04	$6.69	257,094	-22%
2013-2014	$17,095,789	$27.84	$7.35	263,887	-19%
2014-2015	$16,231,427	$26.80	$6.97	260,289	-21%
2015-2016	$15,537,130	$26.68	$6.68	250,205	-24%
2016-2017	$15,342,884	$26.74	$6.59	246,508	-25%
2017-2018	$14,844,728	$28.55	$6.38	223,432	-32%
2018-2019	$14,652,897	$27.78	$6.30	226,681	-31%
2019-2020	$15,185,924	$28.45	$6.53	229,354	-30%
2020-2021	$15,102,753	$28.38	$6.49	228,647	-30%

Table 2: Water/Sewer/Non-potable Consumption Performance Fiscal Year 2002/03 to 2020/21

Fiscal Year	*Total Fiscal Year Cost ($)* *[Water + Sewer + Non-potable]*	*$/1,000 Gallons*	*Gallons/SQFT*	*Gallons/SQFT % Change* *(Compared to 2002-2003)*
2002-2003	$601,556	$5.61	55.39	-
2003-2004	$758,021	$6.19	63.24	+14%
2004-2005	$814,305	$6.01	69.94	+26%
2005-2006	$912,412	$6.51	72.31	+31%
2006-2007	$947,363	$7.19	68.00	+23%
2007-2008	$939,363	$7.79	62.27	+12%
2008-2009	$1,019,309	$8.47	62.15	+12%
2009-2010	$1,244,033	$9.73	55.77	+1%
2010-2011	$1,355,235	$6.61	88.13	+59%
2011-2012	$1,389,014	$10.22	58.39	+5%
2012-2013	$1,192,381	$9.40	54.49	-2%
2013-2014	$1,438,305	$11.38	54.33	-2%
2014-2015	$1,378,546	$11.09	53.42	-4%
2015-2016	$1,347,634	$10.83	53.48	-3%
2016-2017	$1,321,025	$11.02	51.52	-7%
2017-2018	$1,437,922	$11.01	56.11	+1%
2018-2019	$1,377,440	$11.77	50.31	-9%
2019-2020	$1,304,625	$12.10	46.32	-16%
2020-2021	$1,475,234	$13.62	46.55	-16%

Table 3: Energy Cost Avoided (Excludes Water, Sewer, Non-potable), Fiscal Year 2002/03 to 2020/21

Fiscal Year	*Cost Avoidance*
2002-2003	$0 (Baseline Set)
2003-2004	$121,573
2004-2005	-$1,122,418
2005-2006	-$494,632
2006-2007	$423,842
2007-2008	$2,969,439
2008-2009	$2,518,375
2009-2010	$3,241,790
2010-2011	$4,164,737
2011-2012	$5,388,389
2012-2013	$4,282,085
2013-2014	$4,137,616
2014-2015	$4,207,090
2015-2016	$4,815,635
2016-2017	$5,056,887
2017-2018	$6,931,126
2018-2019	$6,533,517
2019-2020	$6,515,232
2020-2021	$6,546,289

Total Energy Cost Avoided =$66,236,573

A. Accomplishments

1. The renovation of one of our chiller plants has been completed which has improved our energy consumption.
2. A fourth high-efficiency chiller has been added to this plant to complete its build-out.
3. Replacement of three cooling towers in chiller plant 2 with higher efficiency cooling towers has been completed.
4. Implementation of the use of Reuse Water has been completed.
5. Yearly tracking of energy consumption is now being performed by Plant Engineering for determining budgeting needs and for tracking usage levels overall.
6. Replaced the inefficient single pane windows located in our Bed Tower section of the Hospital.
7. Replaced exterior building seals on our APCF building to ensure that the building's exterior envelope is intact.
8. Replaced our liquid ring (water based) medical air compressors with oil-less scroll medical air compressors.
9. Replaced two MRI chillers that were at the end of their life cycle.
10. Replaced portions of the Ambulatory Patient Care Facility's North and South side roofing systems that were at the end of their life cycle.
11. Replaced one domestic water booster pump that was at the end of its life cycle.
12. Contracted with American Energy Assets, LLC in 2016 to provide energy savings through operational optimization.
13. Completed operational optimization contract with American Energy Assets, LLC at the end of fiscal year 2019.
14. Replaced the custom fluorescent tube lighting throughout the Women's & Children's Hospital with CFL and LED lighting. This project was spread across multiple years and was completed in FY2019.
15. Entered a monitoring and maintaining agreement with American Energy Assets, LLC in fiscal year 2020 to monitor optimization.
16. Completed redesign and implementation of variable flow for chillers in both chiller plants to optimize chiller loading and minimize chilled water flow thus increasing actual chilled water delta loading and off peak loads in FY2020.

B. Energy Supply Management

1. The University of North Carolina at Chapel Hill's Energy Services Group is the provider of electrical, steam, and some chilled water services to the Hospital.
2. Orange Water and Sewer Authority is the provider of water and sewer service to the Hospital.
3. Dominion Energy is the provider of natural gas service to the Hospital.

C. Energy Use in Facilities

The hospital utilizes a state of the art Building Automation System for monitoring, tuning, and calibrating the Hospital's mechanical systems to maintain optimum control and energy efficiency.

D. Equipment Efficiency

Major new equipment purchases are based on Life Cycle Cost Analysis and replacement equipment is selected based on current efficiency guidelines.

E. Goals

1. Design and construct a new Surgical Pavilion. This project is spread across multiple years. Construction is underway with a planned completion in the fall of 2023.
2. Continued fine tuning of the chiller plant variable flow logic to maximize load profiles and improve energy savings.

Date of Report: *August 23, 2021*

I have read the Strategic Energy & Water plan for my Organization. The plan aligns with the reductions set forth in Senate Bill 668.

Pat Wall, Director
UNC Hospitals Plant Engineering

Strategic Energy Plan

UNIVERSITY OF NORTH CAROLINA
SCHOOL OF THE ARTS

September 2021

1. Table of Contents

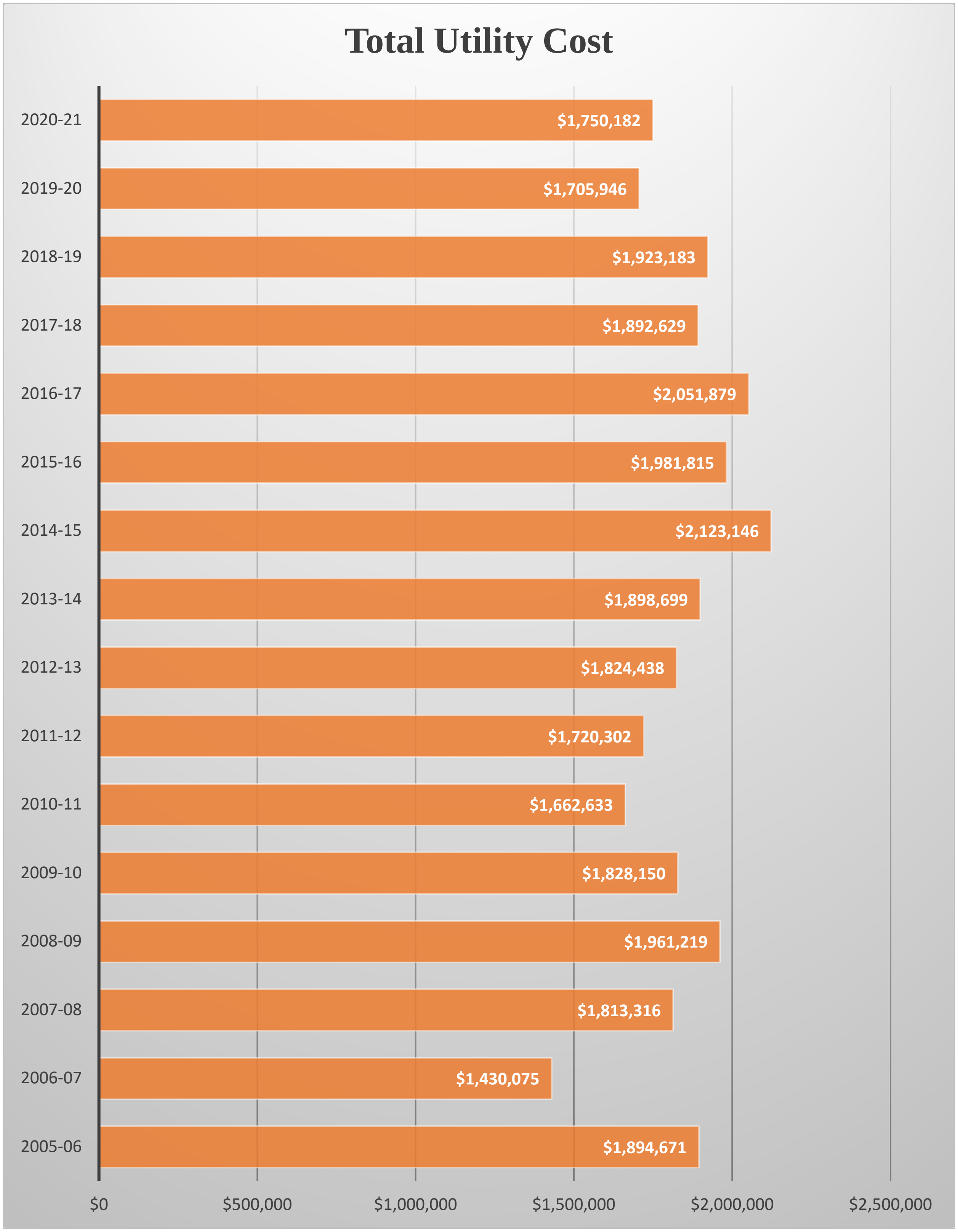
2. EXECUTIVE SUMMARY

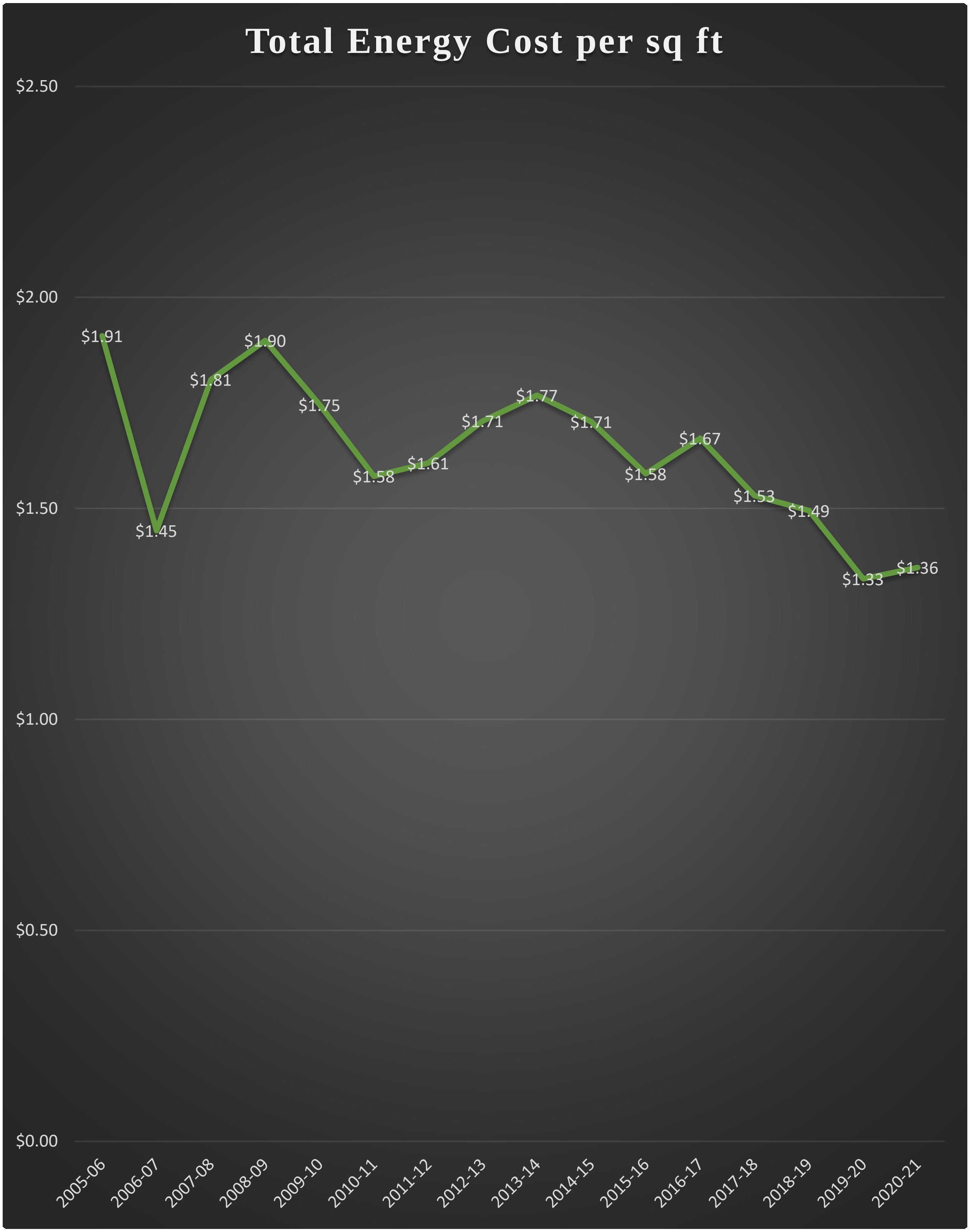
Established by the N.C. General Assembly in 1963, the University of North Carolina School of the Arts was America's first state-supported arts school. It opened in Winston-Salem "The City of Arts and Innovation" in 1965 and became part of the University of North Carolina System when it was formed in 1972.

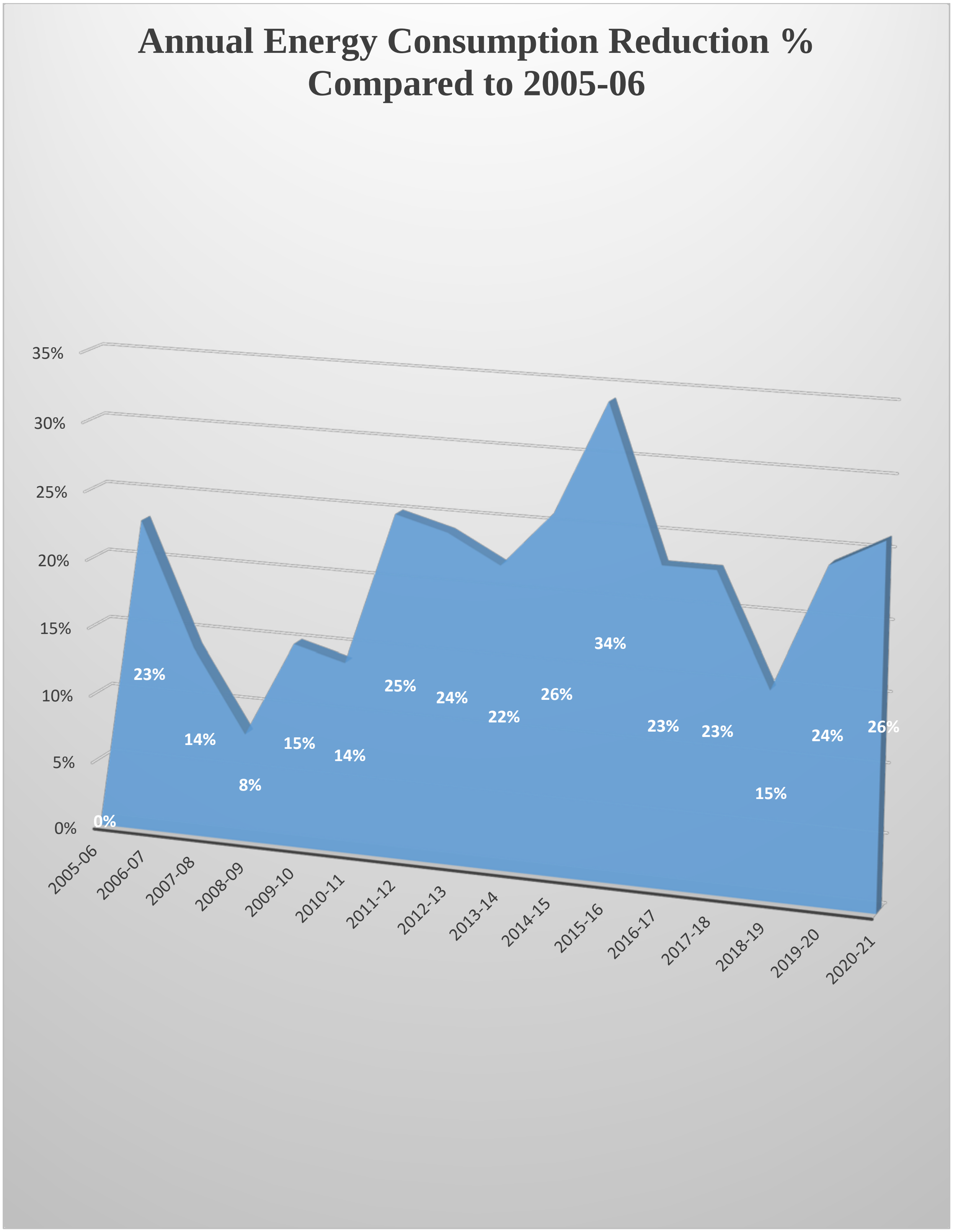
UNCSA is a unique, stand-alone public university consisting of five arts conservatories. They are: Dance, Design and Production, Drama, Filmmaking, and Music. More than 1,300 high school, undergraduate and graduate students are enrolled annually. The campus is south of downtown and is comprised of 47 buildings with 1.15 million square feet of conditioned space, nestled on 70 acres. There are roughly 600 full-time, part-time & adjunct faculty and staff members employed at UNCSA.

UNCSA's utility mix is approximately 60% electricity, 30% natural gas and 10% water. As compared to the baseline fiscal year 2005-06, UNCSA was able to show a cost avoidance of $565,359.00 in the 2020-21 fiscal year. This was due to UNCSA's approach and commitment to energy conservation methods to better manage energy usage, purchase higher efficiency HVAC equipment, efforts to reduce water consumption and continue to replace any incandescent bulbs on our campus with LED's. The University strives to replace aging and energy inefficient equipment, with higher efficiency equipment in order to meet our goals and be more sustainable. Our technicians work in conjunction with contractors to progressively look for opportunities to conserve energy and be better stewards of our resources.

The combined energy dollar amount per square foot is $1.36 this year, up only $0.03 after rate increases from our utility providers during this reporting period. The BTU's used per square foot is 94,562, which is 26% below our baseline year. Water and sewer usage, as measured per building square foot, was down 4% this year as compared to our baseline year 2005-06.


Total Utility Cost
2020-21
$1,750,182
2019-20
$1,705,946
2018-19
$1,923,183
2017-18
$1,892,629
2016-17
$2,051,879
2015-16
$1,981,815
2014-15
$2,123,146
2013-14
$1,898,699
2012-13
$1,824,438
2011-12
$1,720,302
2010-11
$1,662,633
2009-10
$1,828,150
2008-09
$1,961,219
2007-08
$1,813,316
2006-07
$1,430,075
2005-06
$1,894,671
$0
$500,000
$1,000,000
$1,500,000
$2,000,000
$2,500,000


Total Energy Cost per sq ft
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
$1.91
$1.45
$1.81
$1.90
$1.75
$1.58
$1.61
$1.71
$1.77
$1.71
$1.58
$1.67
$1.53
$1.49
$1.33
$1.36
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21


Annual Energy Consumption Reduction %
Compared to 2005-06
35%
30%
25%
20%
15%
10%
5%
0%
0%
23%
14%
8%
15%
14%
25%
24%
22%
26%
34%
23%
23%
15%
24%
26%
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21

3. ENERGY PLAN, GOALS & STRATEGY

The Facilities Management Department strives to raise the awareness of our energy savings initiatives on our campus. We continue to educate and inform our campus community of where we are trying to move the University in respect to energy conservation. A focus has been placed on pursuing higher efficiency HVAC equipment, water heaters, low use water fixtures, lighting controls, etc. While this past fiscal years' utilities costs, as well as for the foreseeable future will continue to be impacted by the COVID-19 pandemic and how we utilize the HVAC systems in our buildings. We strive to work towards lowering our energy use; measured against the health of our students, faculty and staff learning and working in our buildings. We will no doubt continue to consume more energy due to the changes made on our HVAC equipment to lessen the potential impact of the virus and the uncertainties associated with how it spreads. The outside air dampers have been increased to bring in more air to dilute with the buildings recirculated air. We have increased our buildings occupied schedules to ensure we have continuous air changes in all rooms. Also, we have increased all the HVAC systems air filtration systems from MERV-8 to MERV-13 that can be upgraded to that level of filtration, without causing damage or affecting the use of the system.

We currently have a Residence Hall under construction, and it will utilize high efficiency water source heat pumps in the suites and commons areas. Also, we incorporated passive solar into the buildings' design, and it will be well insulated to lessen the demand for heating and cooling. We replaced the Hanes Commons 1999 reciprocating water cooled chiller with a high efficiency centrifugal. The University also replaced 6 HVAC systems in the Performance Place, all of which are higher efficient than the ones they replaced, and we replaced the BAS in the building as well. These projects and others performed this fiscal year, will provide energy savings and energy avoidance in the future.

Additionally, the University has several projects that we are anticipating will be funded soon. These projects will allow us to continue to improve the University's energy consumption, in hopes of reaching our savings goals.

4. COMMITMENT STATEMENT

As a University we understand that energy and water consumption can and needs to be managed to our benefit. The energy and water management is a responsibility of the occupants at each facility, led and supported by Facilities Management.

The Department Heads will review progress and results semi-annually and will support staff attendance in training within energy and water management at least annually.

Strategic Energy & Water Plan Mandate – Goals

1. Reduce energy consumption by 40% per gross square foot by 2025 for all buildings, as compared to the baseline of 2005-06.
2. Require that lights be turned off in interior spaces of unoccupied buildings and upward-directed flood lighting on buildings from midnight to 6am unless required for safety, emergency, or insurance purposes.
3. Require a feasibility analysis for energy conservation measures with a specified schedule and target building sizes. The initial wave would cover buildings greater than 20,000 square feet, in operation for more than 10 years, which have not already been so evaluated within the last three years.

Strategic Energy & Water Plan Mandate – Commitment

I have read and support the Strategic Energy & Water Plan for my Organization
Implemented this 30th day of August in the year 2021.

Christopher M. Bowman	W. Steve Martin	Michael J. Smith
Director of Mechanical Maintenance	Associate Vice Chancellor-Facilities	Vice Chancellor Finance & Administration

The University of North Carolina System Office

THE UNC SYSTEM

Strategic Energy and Water Management Plan

September 2021

Executive Summary

The UNC System Office owns and operates four office/administrative buildings and the UNC President's residence, totaling over 139,000 gross square feet. Energy use across these facilities is currently 128,965 BTUs per square foot which is a 5% increase over last year, but 44% below the 2002-03 baseline. Water use per square foot was 6 gallons which is the lowest level reported since records started being kept in 2002-03. This reflects a 73% decline in water use over the 2002-03 base year. Data is available in Exhibit 1.

Reduced building occupancy resulting from the COVID-19 pandemic was a driver in the significant reduction in water usage. At the same time, there was a small reduction in electricity use (less than 1%), with a significant increase in natural gas usage (20%). Although building occupancy was substantially reduced, facilities continued to be in operation and the need for increased air flow and outside ventilation almost certainly contributed to the resulting increase in natural gas usage and overall energy use per square foot.

Like many corporations, the System Office is using lessons learned from remote work experiences to reassess the need for office space. A consolidation effort is currently underway that will move some staff to remote work on an ongoing basis, some to a hybrid on-site/off-site mix, and some will continue to report to the office daily. This consolidation will provide an opportunity to use the most energy efficient of the facilities more effectively, with a goal of having all office/administrative facilities operating at annual energy use intensity levels (BTUs per square foot) under 100,000.

Energy Supply

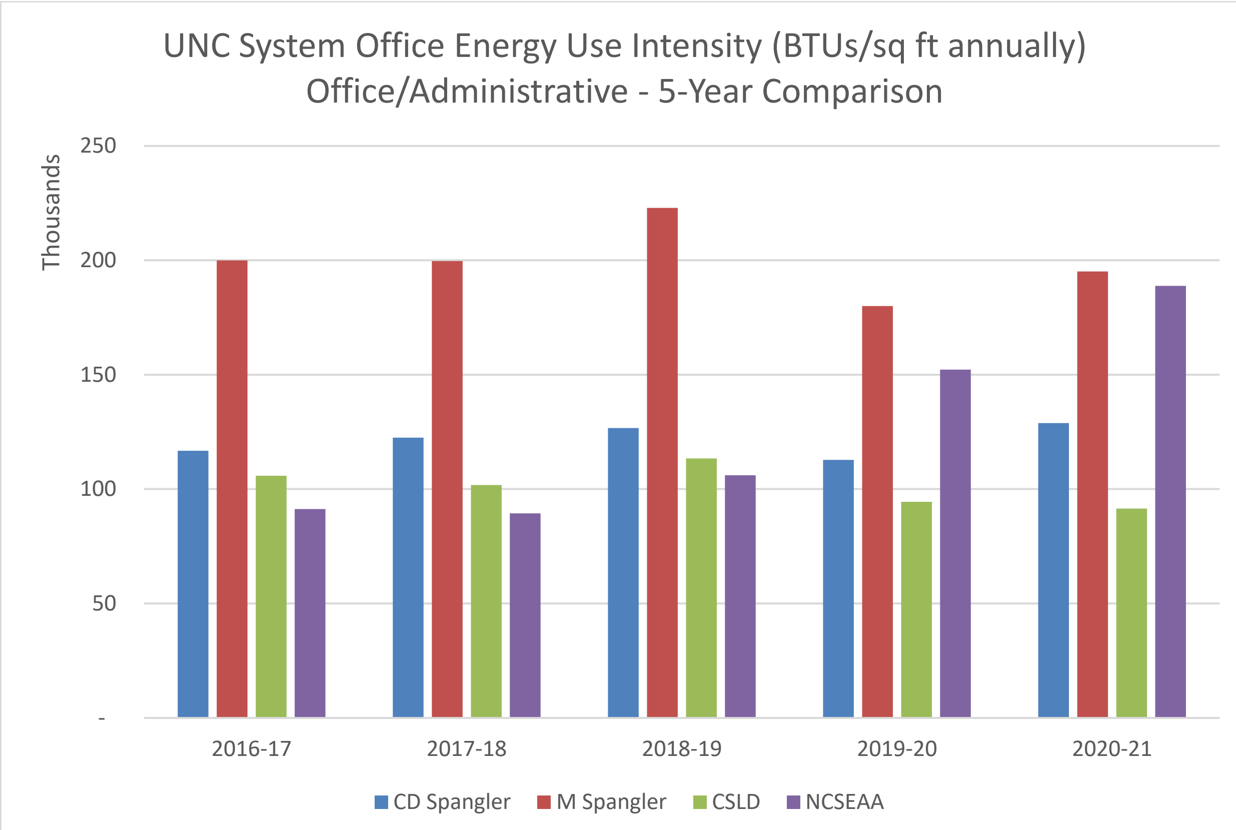
The System Office's energy needs continue to be supplied through UNC-Chapel Hill (UNC) for all existing facilities except the NC State Education Assistance Authority (NCSEAA) which is served directly by local utility firms serving the Research Triangle Park (Duke Energy, City of Durham, and Dominion Energy NC, formerly Public Service Gas).

Energy Demand

Despite the reduced occupancy resulting from COVID-19 closures, the chart below shows an increase in energy use in all facilities except CSLD. The continued operation of the facilities with increases in air flow and fresh air intake as COVID-mitigating strategies increased energy use. The chart also illustrates the significant role that the Meredith Spangler Building and the NCSEAA facility play in System Office energy demand. Both operate at significantly higher energy use intensity than other System Office facilities.

The Meredith Spangler Building is served by the HVAC system installed when the building was constructed in 1980. With pneumatic devices, fixed air flow fan speeds, and no direct digital controls, opportunities to implement occupancy-related temperature set-backs and adjust fan speeds to meet user needs are limited, contributing to higher energy use. NCSEAA is served by a combination of systems including air handling and condensing units at the end of their useful lives, packaged terminal air conditioners (PTAC units), and a mixture of pneumatic and digital controls. The system's various components range in age from 1974 to 2019. HVAC repairs at NCSEAA have improved problems with building humidity, but further worsened energy performance.

Both Meredith Spangler and NCSEAA facilities require substantial investment in their HVAC systems and controls to operate more efficiently. Current plans for consolidating office space call for C.D. Spangler and Meredith Spangler occupants to be relocated to the more energy-efficient Center for School Leadership Development (CSLD) building. Repurposing of those vacated spaces will provide an opportunity to address system deficiencies, particularly in the Meredith Spangler building.



All UNC System Office facilities were a part of the system-wide lighting performance contract executed in 2014. The project included the installation of approximately 1,800 new or retrofit lighting fixtures, 250 replacement light bulbs, and more than 100 lighting control sensors across the System Office's four office/administrative buildings. Savings from the project continue to contribute to reduced energy usage, with savings values summarized in the table below.

Performance Year	Guaranteed Savings	Actual Savings	Shortfall Paid
2017 (Year 1)	$37,702	$35,812	$1,891
2018 (Year 2)	$45,432	$48,313	$ 0
2019 (Year 3)	$46,363	$43,766	$2,597
2020 (Year 4)	$47,312	$44,668	$2,644
2021 (Year 5)	$48,281	$45,783	$2,498
Total	$225,090	$218,342	$9,630*

*This amount is the sum of the shortfall paid column. It is not equal to total guaranteed savings - total actual savings because of the $0 shortfall year.

As building operations stabilize following minor renovations and moves associated with site consolidation, the next year will require assessments to maintain and improve energy efficiency, including consideration of:

- Building operating hours, temperature settings and set-backs
- Site lighting operating hours
- Hot water temperature settings and timers
- Individual appliance policies (coffee pots, microwaves, fans, heaters, etc.)

Water Resources

The US Energy Information Administration reports average water use in office buildings in the range of 15 gallons per square foot annually or about 15 gallons of water use per day per employee. System Office water use per square foot has decreased significantly (40%) from 10.10 to 6 gallons per square foot over the last year, clearly driven by the COVID-caused change in building occupancy.

With the consolidation of staff into the CSLD location, much of the facility's space will change use from event-focused to a more intensive office occupancy. The facility already includes water-saving devices such as low-flow toilets, automatic flushing, and automatic sensor handwashing. Continuing efforts to save water will focus on monitoring and maintaining current gains and examining opportunities involving site irrigation.

Communications and Training

The combination of consolidating staff in a single location with widespread press coverage of fires, floods, and mudslides attributed to changes in climate present a special opportunity for more effectively communicating messages surrounding energy and water conservation while employees are especially alert to their environments. As the consolidation solidifies, energy and water information will be incorporated into existing communication vehicles such as broadcast emails, listserves, and newsletters, as may be useful.

The System Office will also continue to facilitate the sharing of best practices among the institutions throughout the system, engaging facilities operations, capital, and energy staff in discussing how best to construct, operate, and maintain facilities in ways that contribute to long-term cost effectiveness, including energy efficiency.

Exhibit 1
UNC System Office Utilities Data

	energy evaluation						water/sewer evaluation				
year	energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
2002-03		$3.49	$15.07		231,932			$7.27		22.41	
2003-04	$36,361	$2.52	$13.12	-13%	191,787	-17%	$2,300	$7.52	3%	17.98	-20%
2004-05	$35,251	$2.52	$13.07	-13%	192,857	-17%	$2,307	$8.15	12%	18.31	-18%
2005-06	$36,185	$3.02	$15.27	1%	197,608	-15%	$1,564	$8.74	20%	19.82	-12%
2006-07	$27,851	$2.89	$14.19	-6%	203,508	-12%	$2,960	$9.55	31%	17.92	-20%
2007-08	$31,159	$3.06	$15.16	1%	202,156	-13%	$3,295	$10.53	45%	17.88	-20%
2008-09	$33,572	$3.33	$16.44	9%	202,354	-13%	$5,663	$12.00	65%	15.57	-31%
2009-10	$40,262	$3.05	$15.68	4%	194,746	-16%	$7,362	$13.61	87%	14.57	-35%
2010-11	$64,007	$2.82	$16.15	7%	174,523	-25%	$8,430	$14.48	99%	13.98	-38%
2011-12	$260,955	$2.42	$18.55	23%	130,738	-44%	$11,294	$14.74	103%	16.90	-25%
2012-13	$270,479	$2.82	$20.56	36%	137,330	-41%	$34,109	$18.53	155%	9.17	-59%
2013-14	$242,335	$3.13	$21.00	39%	148,928	-36%	$39,956	$20.11	177%	8.12	-64%
2014-15	$263,447	$2.94	$20.83	38%	140,955	-39%	$35,894	$19.00	161%	8.82	-61%
2015-16	$317,293	$2.65	$21.27	41%	124,671	-46%	$32,967	$18.72	157%	9.75	-57%
2016-17	$332,294	$2.44	$20.82	38%	117,177	-49%	$34,788	$18.53	155%	8.91	-60%
2017-18	$296,002	$2.19	$18.64	24%	117,709	-49%	$32,714	$17.83	145%	9.21	-59%
2018-19	$275,697	$2.45	$19.13	27%	128,261	-45%	$34,676	$18.24	151%	8.74	-61%
2019-20	$311,151	$2.32	$19.66	30%	118,106	-49%	$30,953	$18.09	149%	10.10	-55%
2020-21	$260,024	$2.34	$18.16	21%	128,965	-44%	$51,556	$22.60	211%	6.00	-73%

year	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $	chw tons	chw $	kgal water	water sewer $	gsf
2002-03	$252,484	$241,234	16,010,927,596	1,763,783	$90,282	99,929	$150,952	0	$0	1,547	$11,250	69,033
2003-04	$183,040	$173,713	13,239,648,160	1,869,680	$94,880	68,603	$78,833	0	$0	1,241	$9,327	69,033
2004-05	$184,289	$173,987	13,313,486,784	1,854,832	$100,497	69,848	$73,490	0	$0	1,264	$10,302	69,033
2005-06	$220,279	$208,324	13,641,449,888	1,889,024	$100,397	71,961	$107,927	0	$0	1,368	$11,955	69,033
2006-07	$211,220	$199,409	14,048,781,620	1,739,385	$101,616	81,140	$97,793	0	$0	1,237	$11,811	69,033
2007-08	$224,541	$211,550	13,955,435,692	1,857,191	$118,268	76,187	$93,282	0	$0	1,234	$12,991	69,033
2008-09	$242,581	$229,684	13,969,102,924	1,870,927	$139,048	75,855	$90,636	0	$0	1,075	$12,897	69,033
2009-10	$224,546	$210,855	13,443,894,620	1,769,635	$144,263	74,059	$66,593	0	$0	1,006	$13,690	69,033
2010-11	$208,557	$194,580	12,047,815,584	1,752,232	$140,683	60,692	$53,897	0	$0	965	$13,977	69,033
2011-12	$371,788	$337,144	18,179,394,934	2,884,426	$231,448	78,906	$64,239	195,593	$41,457	2,350	$34,644	139,052
2012-13	$416,266	$392,645	19,096,001,297	2,464,312	$194,525	94,494	$80,634	595,969	$117,486	1,275	$23,621	139,052
2013-14	$457,505	$434,805	20,708,696,921	2,507,821	$207,515	107,371	$93,349	657,190	$133,941	1,129	$22,700	139,052
2014-15	$431,491	$408,175	19,600,110,226	2,450,732	$195,943	99,275	$76,892	622,606	$135,339	1,227	$23,316	139,052
2015-16	$394,172	$368,796	17,335,743,908	2,219,322	$174,785	83,578	$55,416	633,789	$138,595	1,355	$25,376	139,052
2016-17	$362,271	$339,309	16,293,702,576	1,970,242	$154,995	81,299	$58,035	653,919	$126,279	1,239	$22,962	139,052
2017-18	$327,875	$305,039	16,367,737,128	1,958,783	$149,576	84,532	$48,860	555,131	$106,603	1,281	$22,836	139,052
2018-19	$363,257	$341,095	17,835,003,880	1,897,286	$148,631	99,470	$72,470	637,778	$119,993	1,215	$22,162	139,052
2019-20	$348,266	$322,850	16,422,823,958	1,935,751	$150,856	85,238	$57,636	583,570	$114,357	1,405	$25,416	139,052
2020-21	$344,549	$325,676	17,932,792,502	1,918,842	$149,822	102,318	$67,092	520,292	$108,763	835	$18,872	139,052

PBS North Carolina Energy Plan for 2021-22

Executive Summary

PBS North Carolina, or PBS NC, (formerly known as UNC-TV) will continue to improve the efficient use and conservation of energy and water resources at all its locations by creating, implementing, and following an effective Energy and Water Management Plan. The objective of the Plan is to guide the fiscally and environmentally responsible usage of valuable resources in accordance with state legislation, while continuing to provide requirements for data centers and striving to ensure a safe positive environment that provides an acceptable level of comfort for staff.

Key elements of the plan include:

- Educating and engaging staff in energy and water conservation through emails and other effective forms of communication that help raise the awareness that effective energy conservation supports the primary mission of PBS NC by using less funding for operating expenses which may provide more funds for strategic purposes.
- Accurate measurement and analysis of electricity, fossil-based fuels, and water usage, including a quarterly review of trends and costs.
- Benchmarking and developing Key Performance Indicators (KPIs) that clearly measure real energy and water conservation progress, factored for facility growth.
- Survey all existing technical systems. Develop an action plan to rebuild PBS NC's technical plant for contemporary television production and broadcast needs. Continue to retire, remove and surplus many obsolete items that draw electrical power.
- Replace 30-year-old chiller plant with state of the art, energy efficient systems.
- Replace multiple 30-year-old air handlers with variable speed systems.
- Training and effective use of staff to perform planned service and upgrades to maintain and improve the performance of facility equipment and vehicles to reduce energy waste.
- Executing approved physical plant equipment projects, process improvements, and vehicle purchases that reduce the net consumption of fossil-based fuels and increase the creation and use of sustainable energy sources.
- Annual review of utility Billing Rates with each supplier, and monthly audit of each utility invoice.
- Applying sustainable building practices in all major facility construction/renovation projects, and in operating and maintenance of buildings in accordance with US Green Building Council / LEED standards to the highest level practical.
- Seeking out and applying innovative energy & water conservation, and energy generation technologies in the design of new facility buildings and land spaces.

1. North Carolina Legislative basis for the Plan:

a. *Session Law 2007-546 / Senate Bill 668* - Energy Consumption per gross square foot to be reduced by 20% by 2010 and 30% by 2015 based on the 2003-2004 fiscal year. Each State institution of higher learning to update its management plan annually and include strategies for supporting consumption reduction requirements. Each State institution of higher learning shall submit to the State Energy Office an annual written report of utility consumption and costs.

b. *Session Law 2008-203 / Senate Bill 1946* - Energy Efficiency Improvement: 30% for major construction projects, 20% for major renovation projects based on 2004 codes. Water Use: for major construction or renovation projects 20% less indoor potable water use, and sum of outdoor potable water use, and harvested storm water use at least 50% less based on 2006 NC Building Code.

2. Organizational Support for Energy Culture Change

a. Work with key members of the Senior Management, Engineering and Facilities to complete development and publicize an Energy & Water Management Policy (E&WM Policy) that defines:
   i. The PBS NC commitment to a fiscally and environmentally responsible Energy and Water Management Plan.
   ii. Measurable and achievable goals with reasonable timelines
   iii. Accountability and resources for Plan implementation
   iv. Continuous Improvement Efforts after initial implementation

b. Complete development of a comprehensive Energy & Water Management Plan (E&WM Plan) to guide:
   i. efforts for initial implementation of the baseline measurement & identification of energy and water conservation opportunities, concept development of projects and process changes, and prioritization of improvement efforts
   ii. provision of funding and staff resources to define, develop, and execute approved energy and water related capital projects, expense projects, and process improvements
   iii. scheduled reviews of conservation efforts and regular updates to the Plan.

c. Educate staff through scheduled emails, handouts, and other effective forms of communication about the E&WM Policy, the E&WM Plan, and in energy & water conservation measures and techniques they can implement in daily PBS NC and home activities.

Organizational Culture Change Projects

Past 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Submit to the State Energy Office an annual written report of utility consumption and costs.	Submit	Submitted	N/A	N/A	Salary		Director of Facilities	State

Next 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Review and revise PBS NC Energy & Water Management Policy	Approval by Senior Mgt.		N/A		Salary		Director of Facilities	State

3. Supply Side

a. Review all accounts with utility providers to ensure lowest cost Rate Schedule is in effect for each facility.
b. Identify locations, meter ID, and account numbers for all existing primary meters installed by utility providers.

Past 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Review all utility bills for all sites and chart them against previous years.	Summary report as well as cost savings	In progress	TBD	TBD	Salary		Facilities and Finance departments	State

Next 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Review all utility accounts and verify lowest rate schedule.	TBD from report	TBD from report	TBD	TBD	Salary		Facilities department and Engineering	State

4. Demand Side

a. With updated controls for 70% of the building working with controls contractor to adjust facility temperatures based on staff occupancy times.
b. Identify potential broadcast operation efficiencies at the Bryan Center, implement them and remove obsolete equipment. It is anticipated that a significant amount of equipment will be turned off, removed, and moved to surplus.
c. Adopt US Green Building Council / LEED energy standards in the design, construction, operation, and maintenance of all new major facility construction projects which will reduce future energy consumption.
d. Perform Energy Audits of HVAC, lighting equipment, and building envelope factors to identify energy waste sources as funds allow. Develop projects and processes to implement any energy savings opportunities identified.
e. Benchmark energy use standards with EPA and other state institutions to guide future equipment replace and upgrade projects:
   i. HVAC
   ii. Lighting
   iii. Roofing
   iv. Fleet Vehicles
   v. Large Motors
   vi. Appliances, Vending
   vii. Computers
   viii. Other misc equipment
f. Replace equipment as required with new Energy Star Rating units.

Past 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Replacement of old, tube type transmitters with new solid-state systems. Also updated several HVAC systems at several transmission sites	Reduction in utility costs.	TBD	TBD	TBD	Salary		Technology Division	FCC US Treasury

Next 12 months Activities	Measurement		Cost Avoidance		Cost	Jobs	Assigned to	Funding Source
	Expected	Actual	Expected	Actual				
Replacement of two centrifugal chillers	Reduction in utility costs	TBD	TBD	TBD	Salary		Technology/Facilities Department	State of North Carolina
Replacement of several air handlers	Reduction in utility costs	TBD	TBD	TBD	Salary		Technology/Facilities Department	State of North Carolina

STRATEGIC ENERGY & WATER MANAGEMENT PLAN

2021 PLAN UPDATE

Table of Contents

Executive Summary

The University of North Carolina Asheville (UNC Asheville) is a public liberal arts institution located on a 365 acre campus within the mountains of Western North Carolina. The University has forty-eight (48) mission critical buildings, totaling over 1.79 million square feet, serving over 3,300 students and 720 faculty and staff.

This Strategic Energy and Water Management Plan is submitted to the North Carolina State Energy Office, fulfilling its requirement of updating the plan on a biannual basis, on odd numbered years. This is the plan cycle for fiscal years 2021-23.

Key Performance Indicators

UNC Asheville tracks Key Performance Indicators (KPI's) for energy and water consumption to monitor the performance of its facilities. These KPI's take total consumption and normalize them with a standard metric allowing for comparison to previous years, and other institutions within the UNC System. The KPI's utilized for energy and water are outlined below:

- The KPI for energy consumption is referred to as Energy Use Intensity (EUI), and is the total annual energy consumption of the University, in units of kBtu, divided by the total building gross square footage (GSF). Energy sources utilized by the University include electricity, natural gas, and propane.
- The KPI for water consumption is referred to as Water Use Intensity (WUI), and is the total annual water consumption of the University, in units of gallons, divided by the total building gross square footage (GSF).

This plan cycle, including fiscal years 2019-20 and 2020-21, was significantly impacted by the COVID-19 Global Pandemic. Although the University kept all buildings occupied, changes in building operation and occupant density had a significant impact on utility consumption. The drop in occupant density alone goes beyond the recorded drop in FTE's, as there was a shift to remote working and learning throughout the pandemic which is not reflected in this metric. These impacts will be discussed in more detail later in this report, but fiscal years 2019-20 and 2020-21 yielded a modest reduction in the KPI for energy consumption and significant reduction in the KPI for water consumption, both reaching their lowest values recorded since the baseline year.

Table 01. 2015-19 Key Performance Indicators

	FTE (people)	GSF (sq ft)	EUI (kBtu/GSF)	WUI (gal/GSF)
2017-18	4,523	1,635,988	78.1	19.8
2018-19	4,503	1,750,062	74.9	17.5
2019-20	**4,274**	**1,783,119**	**71.3**	**18.4**
2020-21	**4,046**	**1,791,866**	**71.7**	**12.0**

FTE – Full Time Equivalent population of students, faculty, and staff on campus. Data obtained from the Office of IREP.
GSF – Gross Square Footage of all buildings on campus
EUI – Energy Use Intensity
WUI – Water Use Intensity

Within the UNC System, the baseline year established for reporting purposes is the 2002-03 fiscal year. UNC Asheville's baseline KPI for energy and water is 93.4 kBtu/GSF and 28.5 gal/GSF respectively.

Graph 01. Percent Change in KPI from Baseline Fiscal Year

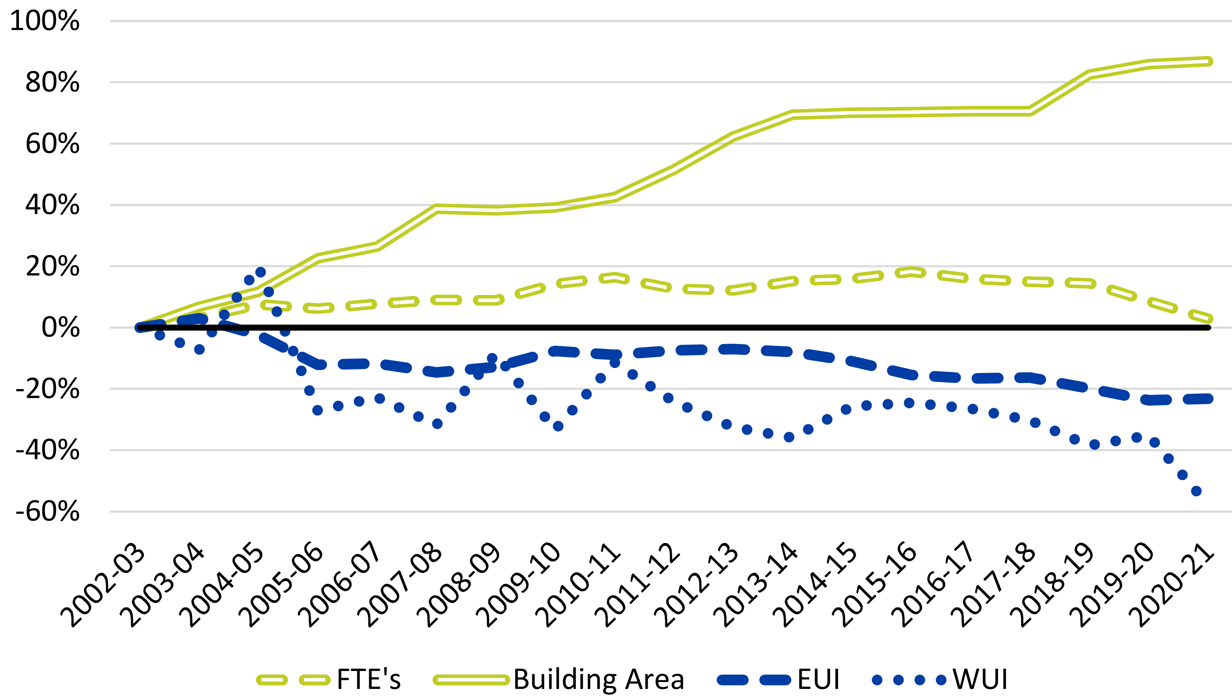


Table 02. Percent Change in KPI from Baseline Fiscal Year

	Full Time Equivalents (FTE)	Building Area (GSF)	EUI (kBtu/GSF)	WUI (gal/GSF)
2002-03	-	-	-	-
2003-04	3.2%	6.9%	3.1%	-7.3%
2004-05	7.6%	11.8%	-2.5%	19.7%
2005-06	6.2%	22.6%	-12.2%	-27.1%
2006-07	7.8%	26.5%	-11.7%	-22.8%
2007-08	9.1%	38.8%	-14.7%	-31.8%
2008-09	8.9%	38.3%	-12.9%	-8.6%
2009-10	14.3%	39.3%	-7.7%	-33.3%
2010-11	16.4%	42.5%	-8.9%	-11.4%
2011-12	12.7%	51.5%	-7.4%	-24.1%
2012-13	12.2%	62.4%	-7.0%	-32.4%
2013-14	15.3%	69.5%	-8.0%	-36.0%
2014-15	16.0%	70.1%	-11.0%	-25.7%
2015-16	18.3%	70.3%	-15.5%	-24.5%
2016-17	16.0%	70.6%	-16.7%	-26.4%
2017-18	15.0%	70.6%	-16.3%	-30.3%
2018-19	14.5%	82.5%	-19.8%	-38.4%
2019-20	8.7%	86.0%	-23.6%	-35.2%
2020-21	2.9%	86.9%	-23.2%	-57.8%

Introduction

Legislative Background & Purpose

In 2001 the North Carolina General Assembly enacted General Statute 143-64.12, which required each State Institution to develop and implement a comprehensive energy and water management plan. The General Statute also required that energy consumption per gross square foot for all State buildings, in total, be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 when compared to the baseline 2002-03 fiscal year. Energy consumption per gross square foot is a measure of Energy Use Intensity (EUI).

During fiscal year 2015-16 the UNC System achieved its goal with a reduction in EUI of 31.2%. Following on this success, the UNC System has committed to a voluntary goal to further reduce its EUI by forty percent (40%) by 2025, based on the same baseline 2002-03 fiscal year.

To maintain legislative compliance, and demonstrate good faith efforts towards pursing voluntary goals within the UNC System, Universities continue to submit their comprehensive energy and water management plan on a biannual basis, on odd-numbered years.

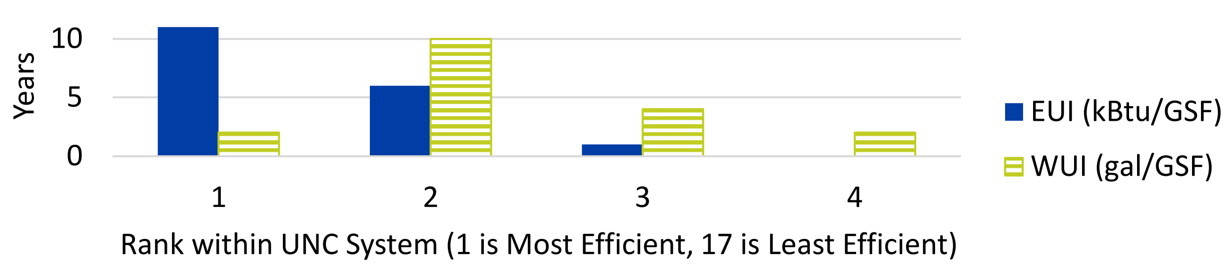
History of Sustainability

UNC Asheville has a history of environmental stewardship dating back to the 1970's, when the University adopted its first policy addressing energy management, which established and implemented standard thermostat set points across campus. Over the years our understanding of our natural environment, and what it means to be sustainable, has evolved and woven itself into the fabric of the University and its strategic plan:

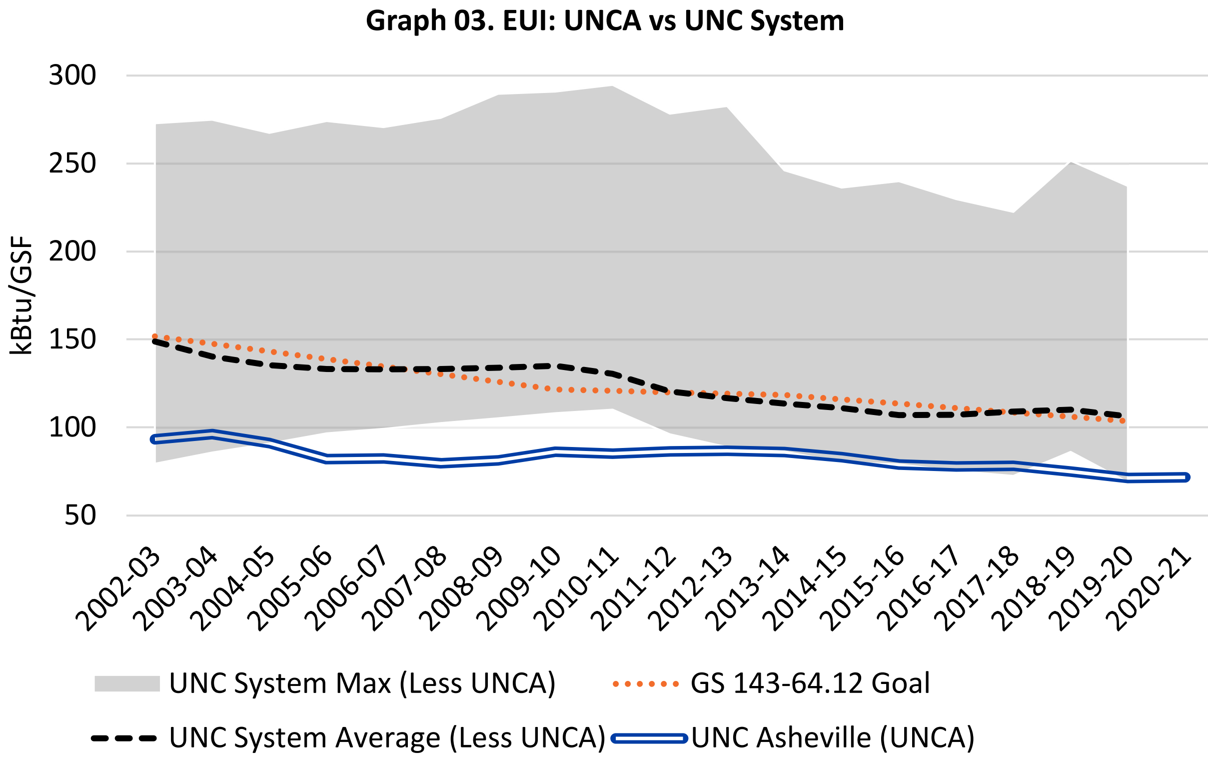
> "Success also requires innovation, encouraging everyone to take risks, try new ideas, and spread good ideas across our community. Success requires a strong commitment to holding ourselves accountable as we strive to meet our goals. To be a successful university of the future we will commit to a culture of sustainability, continuously finding new ways to support the natural environment, our communities, and the long-term health of the institution and her people."

The University's systematic, and self-initiated, approach to energy and water management was validated when the North Carolina General Assembly enacted General Statute 143-64.12. This required tracking of KPI across the UNC System for both energy and water efficiency. For the existing data set, available for fiscal years 2002-03 through 2019-20, UNC Asheville has not ranked lower than third within the UNC System for energy efficiency, and fourth for water efficiency.

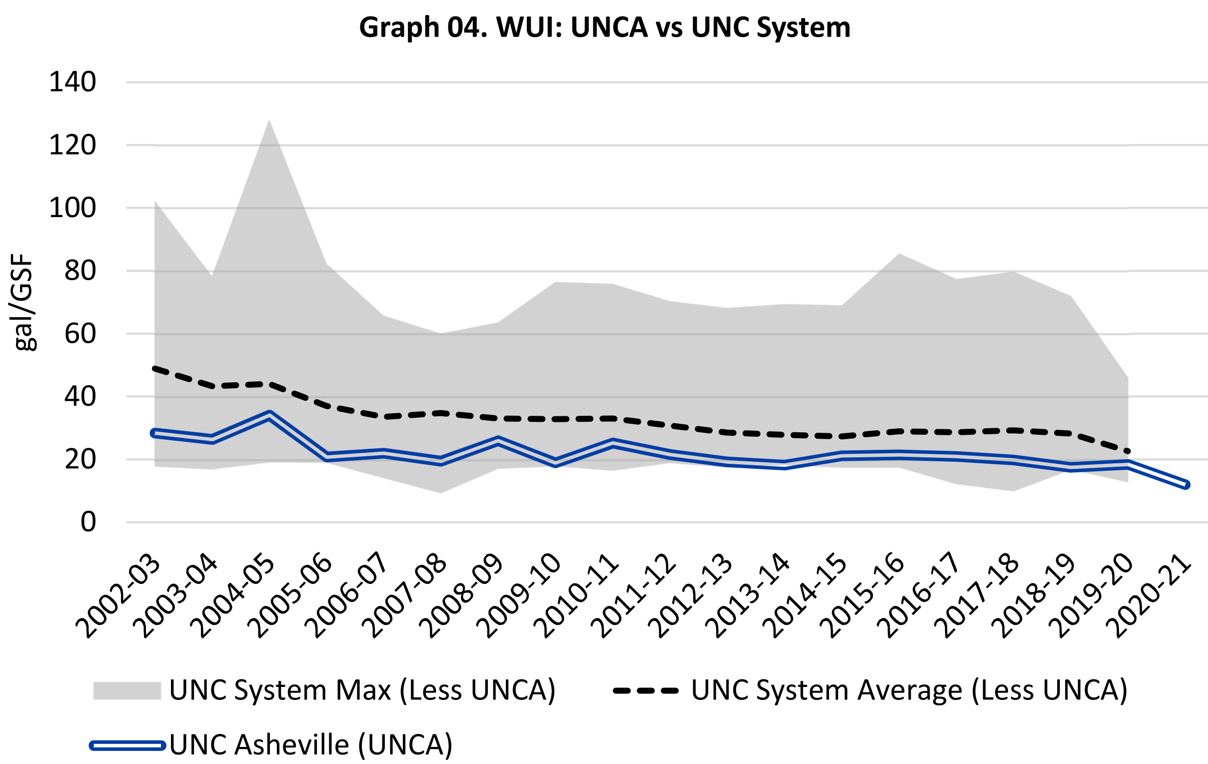
Graph 02. UNCA's KPI Rank within UNC System



In the baseline fiscal year, UNC Asheville had an EUI of 93.4 kBtu/GSF. The average EUI within the UNC System in the baseline fiscal year was 149.0 kBtu/GSF.



In the baseline fiscal year, UNC Asheville had a water use KPI of 28.5 gal/GSF. The average water use KPI within the UNC system in the baseline fiscal year was 49.0 gal/GSF.



Energy & Water Use Analysis

Impact of the Global Pandemic

The University kept all buildings occupied throughout the pandemic, and the combined efforts of many departments to limit the spread of COVID-19 had a significant impact on utility consumption this plan cycle. Several of the more significant measures implemented are outlined below:

- Building operation schedules, ventilation and exhaust rates, and air filtration efficiency were evaluated and adjusted as necessary. This resulted in several buildings having increased operating hours and/or increased ventilation and exhaust rates.
- Classroom density was reduced to maintain social distancing guidelines and classrooms were set up for hybrid teaching.
- University employees capable of working remotely were encouraged to do so.
- Every other flushing fixture in multi-occupancy restrooms were shut down to maintain social distancing guidelines.
- Scope of dining services was significantly reduced.
- Large events were reduced in scope and/or canceled.

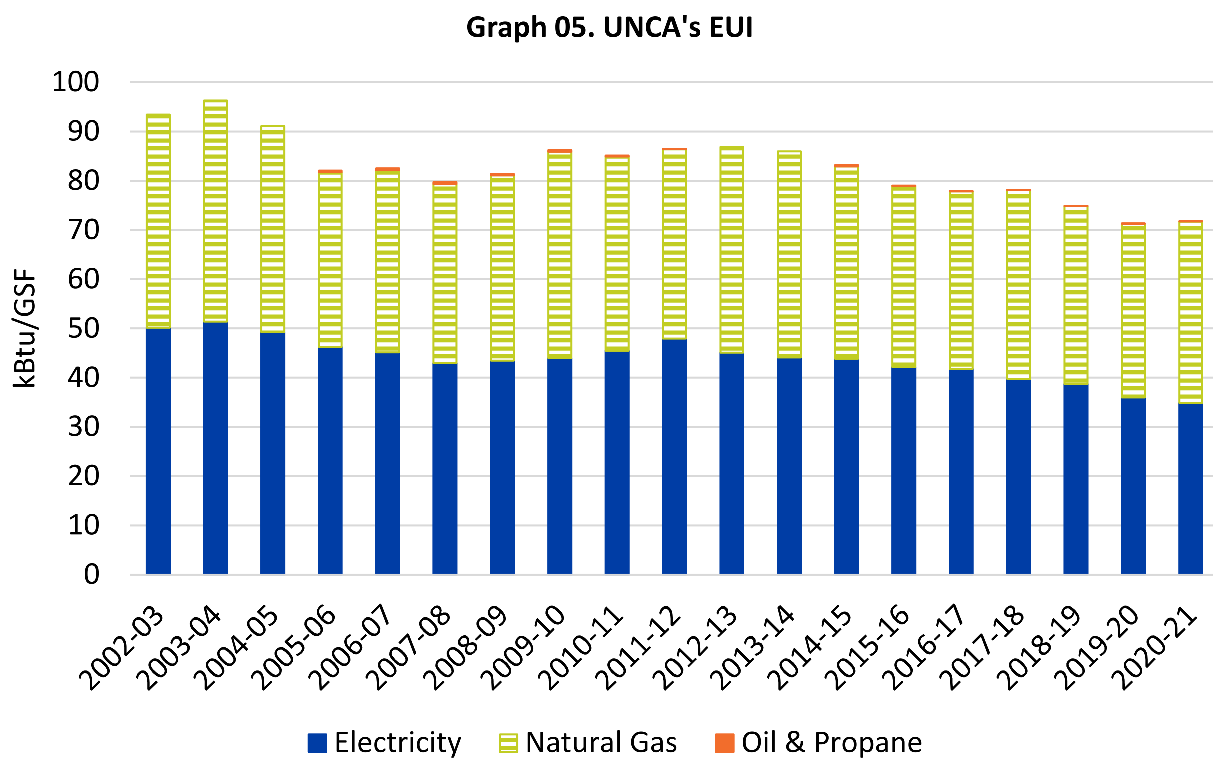
These actions resulted in a steep decline in utility consumption for processes directly tied to occupancy, such as domestic water use, plug loads, interior lighting, etc. Utility consumption for processes more closely related to building and campus operation remained more stable, such as building conditioning, ventilation, exterior lighting, etc.

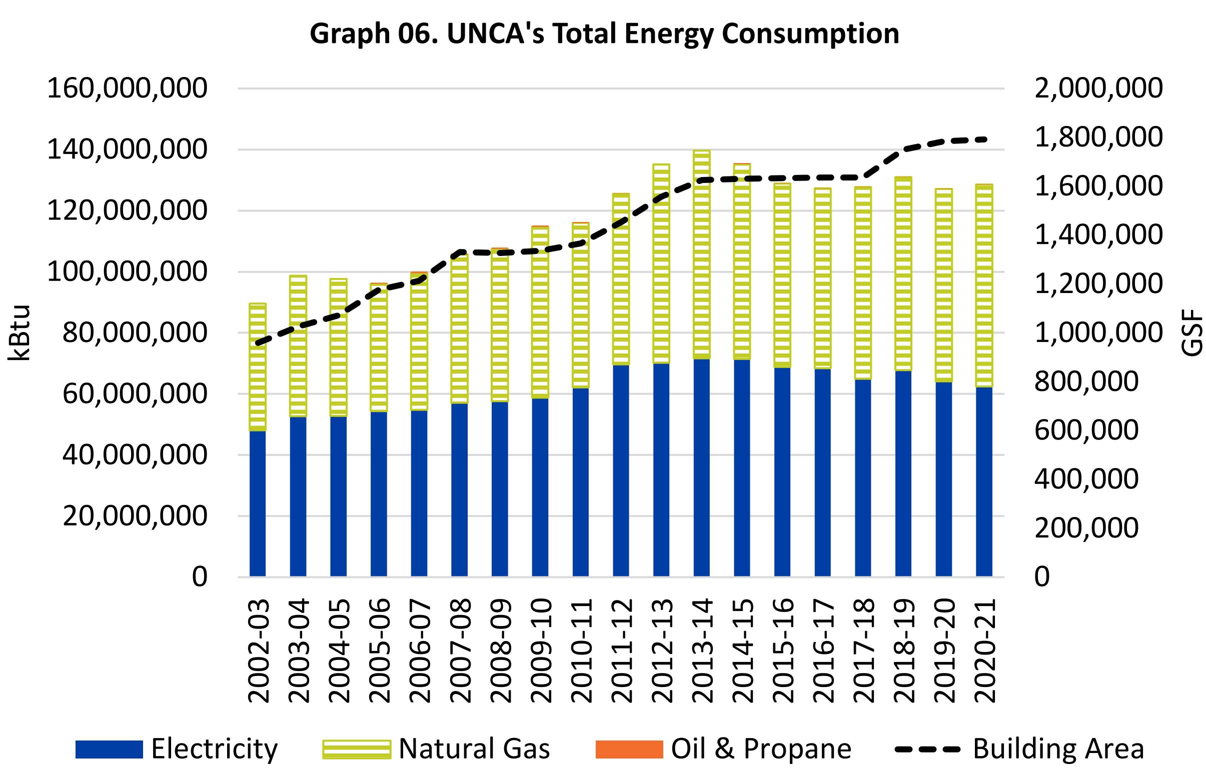
Energy Consumption

Comparing fiscal years 2019-21 with the previous plan cycle of 2017-19, total enclosed building area on campus increased by 9.5% while average total energy consumption was reduced by 1.2%, leading to the University's lowest recorded EUI's, at 71.3 and 71.7 kBtu/GSF for fiscal years 2019-20 and 2020-21 respectively. This was driven by a reduction in total electricity consumption, which dropped below 19,000 MWh annually for the first time since fiscal year 2010-11 when there was 24% less enclosed building area on campus.

Although there was a reduction in cooling degree days, this does not have a strong correlation with the University's electricity consumption. This is due to a number of factors, including a large baseload, occupancy variance during the majority of the cooling season, and the addition of several ground source heat exchange systems on campus. Instead, the 4.7% reduction in electricity consumption over this two-year plan cycle can be attributed to a reduction in occupancy, which impacts plug loads, lighting loads, and cooling demand.

The University's natural gas consumption does show a strong correlation to heating degree days, which explains the 2.4% increase in natural gas consumption over this two-year plan cycle despite reduced occupancy. Natural gas is consumed for building heating, domestic water heating, and hot water reheat. Domestic water heating and hot water reheat are relatively small baseloads, and therefore natural gas consumption closely tracks heating degree days, as it is related to building heating.



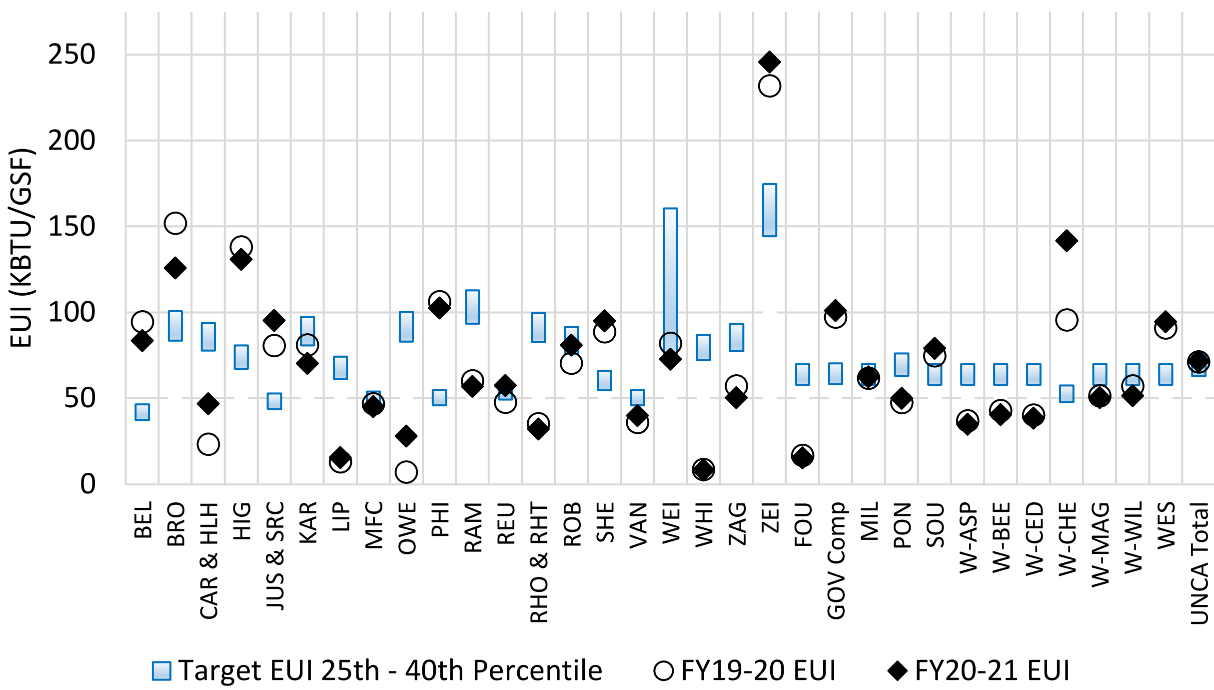


Building Specific Analysis of Energy Consumption

UNC Asheville has a variety of building types and various occupancies within those buildings. To evaluate individual building performance from year-to-year, building specific target EUI's had to be established, and impact of weather on building energy consumption had to be determined.

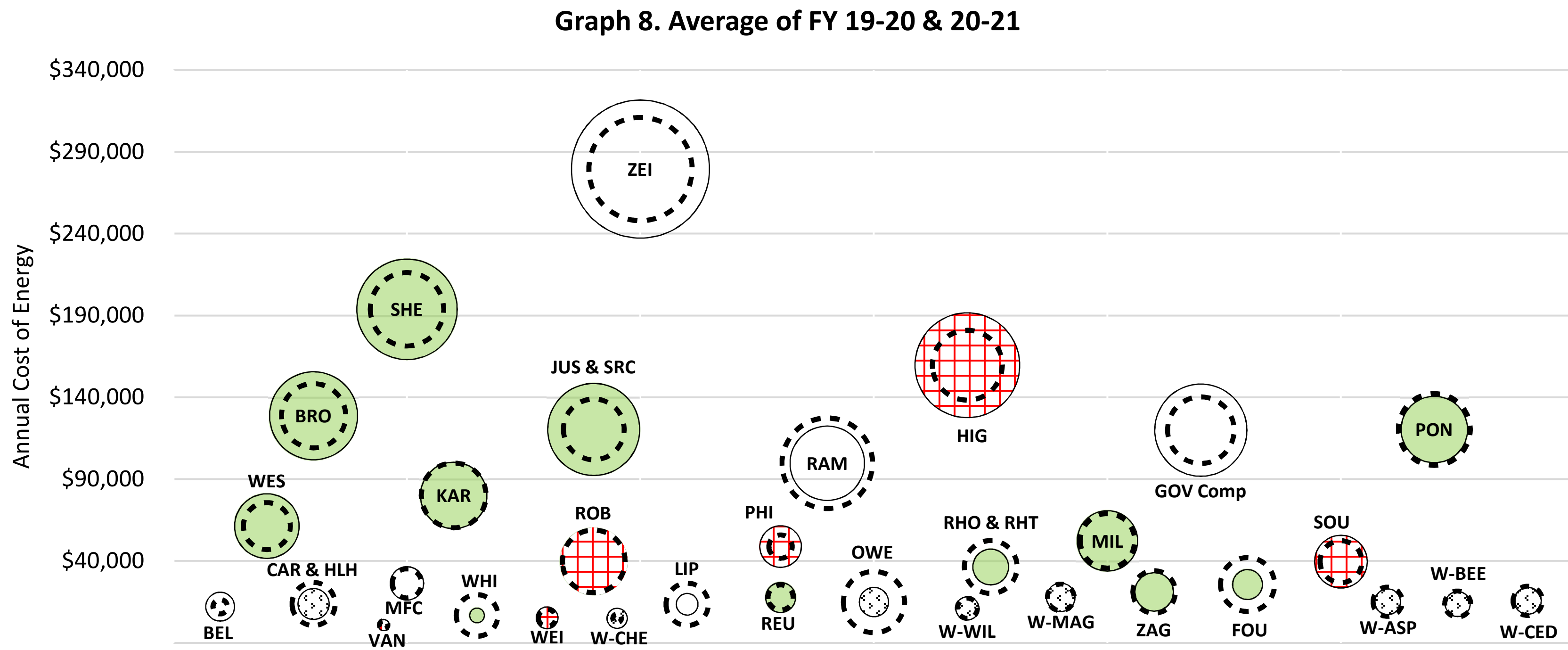
ASHRAE Standard 100, Energy Efficiency in Existing Buildings, establishes target site EUI's per climate zone and occupancy type on a weighted average basis. Following the process outlined in the standard, two target site EUI's were established for each building: the 40th and 25th percentiles. These percentiles represent the specific site EUI that only 40% or 25% of the buildings with the same occupancy would have a lower EUI. If a buildings EUI is greater than the 40th percentile, it requires further investigation, between the 40th and 25th percentile is lower priority, and below the 25th percentile is performing well. The graph below shows the band of EUI's within the 25th-40th percentile for each building, and the building EUI for the last two fiscal years.

Graph 07. ASHRAE 100 Target vs Actual EUI



To understand the impact of weather on specific building's energy consumption, multiple regression analysis were run on each building's electricity and natural gas consumption for fiscal years 2015-16, 2016-17, 2017-18, and 2018-19 to establish a correlation between a buildings utility consumption and degree days, both heating and cooling. A base temperature of 65F was selected as a reasonable compromise across campus. Energy consumption for each building can now be projected based on real and estimated weather conditions. These equations will be updated every plan cycle.

The results of this analysis are shown in Graph 8, which will be used throughout this next plan cycle to quickly inform where investments need to be made to reduce overall energy consumption and investigate reasons for why specific buildings consumed more energy than projected.



Notes

- Circles represent energy consumption, larer circles mean more energy consumption, smaller circles mean less energy consumption
- Vertical axis represents average cost of energy for fiscal years 2019-21
- Thick dashed circle: 25th percentile target energy consumption
- Thin solid circle: average energy consumption for fiscal years 2019-21.
- Green fill within the thin solid circle means the building consumed less energy than projected for fiscal years 2019-21
- Red hatched fill within the thin solid circle means the buidling consumed more energy than projected for fiscal years 2019-21
- No fill within the thin solid cirlce means the building consumed as much energy as projected for fiscal years 2019-21
- Black hatched fill within the thin solid cirlce means there wasn't enough historical data to project energy consumption

Examples

- Sherill Center (SHE) had an average annual cost of energy is just over $190k, performed better than projected for fiscal years 2019-21 (green fill), but still worse than the target 25th percentile (thin solid circle is well outside of the thick dahsed circle).
- Robinson Hall (ROB) had an average annual cost of energy is about $40k, performed worse than projected for fiscal years 2019-21 (red hatched fill), and just over the 25th percentile (thin solid circle is just outside of the thick dashed circle).
- Aspen Hall (W-ASP) had an average annual cost of energy below $40k, does not have enough historical data to project energy consumption (black hatched fill), but performed slightly better than the target 25th percentile (thin solid circle is just inside of the thick dashed circle).

Water Consumption

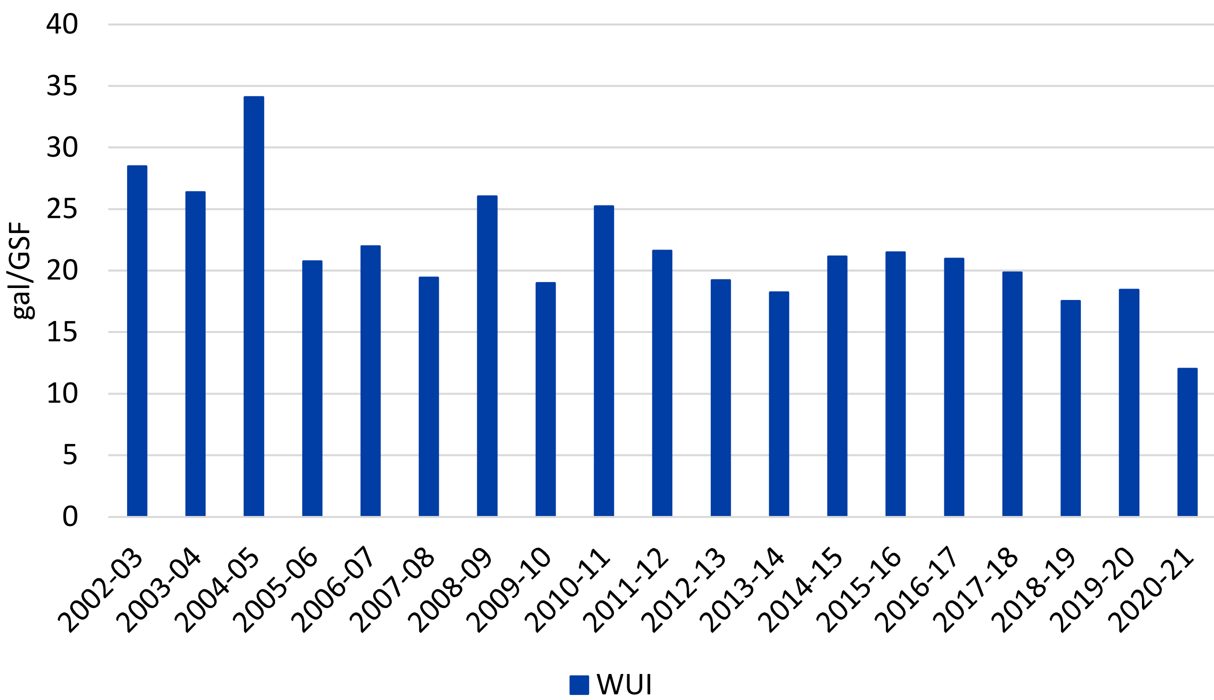
While the overall trend in water consumption has been going down, on a year-to-year basis it has been volatile despite continued use of low flow plumbing fixtures and limited use of water in landscaping. This last fiscal year's reduced occupancy due to the global pandemic, resulted in a record low water consumption, below even the baseline fiscal year of 2002-03 when there was 46% less enclosed building area on campus. This also resulted in a record low WUI.

The official reporting KPI for water consumption to the State Energy Office is gal/GSF. UNC Asheville is tracking a second KPI for water consumption, kgal/FTE. Under normal conditions, it is believed that water use per full time equivalent occupant is a more accurate representation of performance concerning water consumption. However, due to factors such as remote teaching and remoting working, occupancy across campus can not be assumed to be equivalent to FTE's recorded for this plan cycle. It is therefore difficult to take draw any conclusions from this plan cycle other than less people on campus resulted in less water consumption.

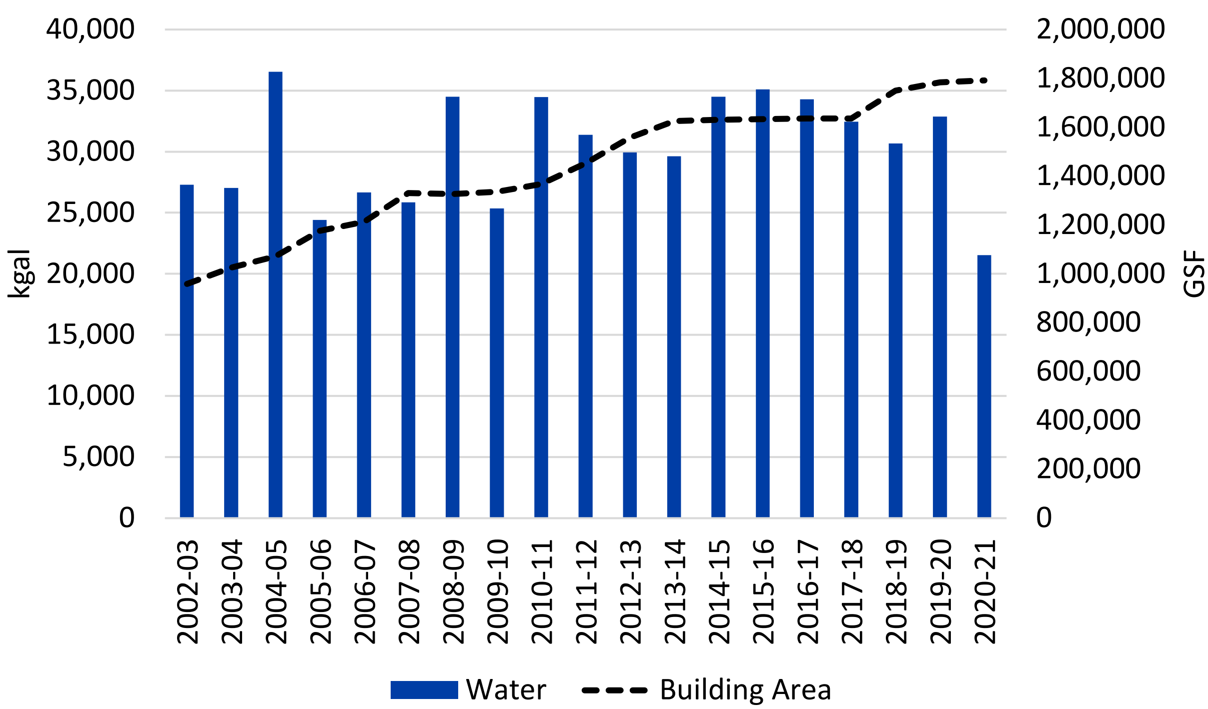
Moving forward, work will be completed to create target values for individual building water consumption based on their FTE load. Outside of a large change in occupancy, this will be the most accurate way to establish targets and monitor a building's water use.

	Table 03. UNC Asheville's Water Consumption			
	KPI Based on GSF		KPI Based on FTE	
	gal/GSF	% Change Baseline FY	kgal/FTE	% Change Baseline FY
2002-03	28.5	-	6.9	-
2003-04	26.4	-7.3%	6.7	-4.0%
2004-05	34.1	19.7%	8.6	24.3%
2005-06	20.8	-27.1%	5.8	-15.8%
2006-07	22.0	-22.8%	6.3	-9.5%
2007-08	19.4	-31.8%	6.0	-13.1%
2008-09	26.0	-8.6%	8.1	16.1%
2009-10	19.0	-33.3%	5.6	-18.8%
2010-11	25.2	-11.4%	7.5	8.5%
2011-12	21.6	-24.1%	7.1	2.0%
2012-13	19.2	-32.4%	6.8	-2.2%
2013-14	18.2	-36.0%	6.5	-5.8%
2014-15	21.1	-25.7%	7.6	8.9%
2015-16	21.5	-24.5%	7.5	8.6%
2016-17	21.0	-26.4%	7.5	8.3%
2017-18	19.8	-30.3%	7.2	3.4%
2018-19	17.5	-38.4%	6.8	-1.9%
2019-20	18.4	-35.2%	7.7	10.8%
2020-21	12.0	-57.8%	5.3	-23.4%

Graph 09. UNCA's WUI



Graph 10. UNCA's Total Water Consumption



Strategic Initiatives

The University of North Carolina Asheville (UNC Asheville) has four areas of concentration for this two (2) year Strategic Energy and Water Management Plan cycle: Utility Management, Building Automation System Optimization, Facility Projects, and Outreach.

Utility Management

Effective utility management requires a comprehensive understanding of campus wide utility distribution, how and where the utilities are measured, and how data and utility billing are processed within the University. Strategic initiatives within this area of concentration are aimed at process improvement and are anticipated to lead to projects with identifiable savings for the next strategic plan cycle.

Plan Year Initiated	Initiative	Measurement	Savings	Cost & Funding Source	Assigned to	Work Completed	Continued Work	Plan Year Closeout
2017-2019	Complete campus wide utility, and meter, audit.	Not applicable.	Not applicable.	No project costs identified beyond staff salary.	Dan Croisant	All domestic water, natural gas, and electricity meters have been identified and logged.	Completed	Closed 2020
2017-2019	Explore options with utility providers to install pulse counters on existing meters.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant	Pulse counters have been installed on natural gas meters in new construction and renovation projects. Utility provider is hesitant to install pulse counters on existing meters in the field. Any work associated with this would incur fees.	As funding becomes available for installation of pulse meters on existing buildings, obtain pricing from the utility provider.	Ongoing
2017-2019	Evaluate options for third party bill payment administration.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant	One (1) company was identified, Capturis, that has a contract with the UNC System to provide these services. A cost analysis will be completed to determine feasibility in this plan cycle.	Obtain pricing from Capturis for full services on an annual basis, engage Administration & Finance in this discussion, and schedule a demo with Capturis if there is mutual interest.	Anticipated 2022
2017-2019	Explore options with utility providers to consolidate billing on accounts per funding source.	Not applicable.	Not applicable.	No project costs identified beyond staff salary.	Dan Croisant	This initiative was conceived to reduce potential fees with "third party bill payment administration". Certain third party entities charge for services based on total number of bills processed instead of total meters billed. The third party identified, Capturis, charges based on total meters billed, therefore this initiative is no longer relevant.	Not applicable.	Closed 2019
2017-2019	Update utility distribution plans.	Not applicable.	Not applicable.	No project costs identified beyond staff salary.	Dan Croisant	Utility distribution plans have been updated with new survey information, and as systems change via renovation and new construction.	This is an ongoing initiative.	Ongoing
2017-2019	Develop estimates for submetering all building level utilities & integrating with the BAS.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Tony Delaurentis	Estimates have been obtained for submetering all electric meters on campus. Buildings are being prioritized based on age of existing meters, total consumption, and ease of installation.	Project requires funding source to move forward.	Unknown
2017-2019	Investigate alternate methods for funding ECM's.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Office of Sustainability	This is an ongoing initiative that is revisited as funding opportunities change with legislation.	This is an ongoing initiative.	Ongoing
2019-2021	Install master domestic water meter at WT Weaver main. This has the potential to significantly reduce annual utility costs. Savings, depending upon scenario, start at approximately $30,000 per year.	Meter charge on utility bills.	To be determined.	Repair and Renovation	Dan Croisant	This work has been completed and the University has a master meter on the W.T. Weaver Blvd main and the Broadway main water feeds.	Monitor utility cost savings and ongoing maintenance costs.	Closed 2020
2021-2023	Reevaluate individual building target EUI's and align with current University plan of achieving net zero carbon emissions by 2050.	Not applicable	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Office of Sustainability	Established individual building target EUI's.	Work with the Office of Sustainability to determine next steps for identifying paths to net zero.	Anticipated 2023

Building Automation System Optimization

A properly functioning Building Automation System (BAS) provides a comfortable and healthy environment for building occupants, while minimizing total building energy consumption. Strategic initiatives within this area of concentration are aimed at leveraging the advantages of UNC Asheville's single, and integrated, campus wide BAS and move beyond building automation to building optimization.

Plan Year Initiated	Initiative	Measurement	Savings	Cost & Funding Source	Assigned to	Progress	Continued Work	Plan Year Closeout
2017-2019	Adjust campus wide cooling setpoint to bring the University into compliance with the NC ECC requirement on deadband and provide energy savings.	Monitor electric consumption on building level submeters.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	Campus wide setpoints were established at 70F heating and 75 F cooling. This provided the 5F deadband as required by the NC ECC.	Not applicable.	Closed 2018
2017-2019	Reevaluate electric demand thresholds that initiate Demand Levels 1-3, on the campus wide Demand Limiting System.	Monitor peak demand at substation, and at building level submeters with demand recording capabilities.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	To date, existing control logic has been reviewed to ensure that demand limiting functions have been implemented uniformly across campus, systems, zones, and equipment. This was a key first step to make prior to changing any demand limiting levels.	Then next step is to review the demand limiting levels.	Ongoing
2017-2019	Review existing control strategies within the BAS and identify opportunities for energy conservation. Examples include implementation of trim-and-respond control capabilities on airside and hydronic systems, temperature reset, etc.	Monitor building level submeters for applicable variations in utility consumption.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	Trim-and-respond has been implemented as a control strategy in the standard logic files for implementation across campus. This is being utilized in all building control upgrades.	This is an ongoing initiative.	Ongoing
2017-2019	New control program and sequence of operation installed in Ponder Hall, in August 2017 to improve equipment operation and energy savings. Building will be tuned over the next six (6) months.	Building utilities are submetered and will be monitored for performance.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	There was a slight decrease in overall energy use at Ponder Hall, but equipment operation and occupant comfort increased significantly from the changes made to the control program and sequence of operation. The EUI for Ponder Hall was as follows: FY16-17 54.2 kBtu/GSF, FY17-18 57.4 kBtu/GSF, FY18-19 52.2 kBtu/GSF, FY19-20 47.7 kBtu/GSF, FY20-21 49.9 kBtu/GSF	Not applicable.	Closed 2019
2017-2019	Continue to go building-by-building to institute standard logic control of systems and layout of logic.	Monitor building level submeters for applicable variations in utility consumption.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing

Facility Projects

UNC Asheville has leveraged facility projects to not only meet the needs of the University, but to also advance energy and water conservation. Strategic initiatives within this area of concentration have been identified for implementation within this plan cycle; however, this is not an exhaustive list as conservation is considered in all emergency equipment repairs and/or replacements.

Plan Year Initiated	Initiative	Measurement	Savings	Cost & Funding Source	Assigned to	Progress	Continued Work	Plan Year Closeout
2017-2019	A Karpen Hall chilled water distribution alterations to allow for variable flow control.	Monitor electric consumption on building level submeters.	Estimated via Trane Trace to be 29,922 kWh per year.	Project cost: $40,000	Dan Croisant	Electric consumption in Karpen Hall dropped from ~1.67 MWh in FY16-17 to ~1.48 MWh in FY17-18 and FY18-19.	Not applicable.	Closed 2017
2017-2019	Continue with reduction of lighting intensity to 50% of installed capacity within appropriate spaces on campus.	Monitor electric consumption on building level submeters.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant	This work has been completed.	Not applicable.	Closed 2019
2017-2019	Continue conversion of exterior lighting to LED's that were not included within the lighting performance contract.	Monitor electric consumption at the substation.	To be determined.	Ongoing as funding through operating budget allows.	Dan Croisant	This work has been completed.	Not applicable.	Closed 2019
2017-2019	Conversion to low-flow water fixtures as existing fixtures are replaced.	Monitor water consumption at building level meter.	To be determined.	No project costs identified beyond staff salary. Fixture costs not included, as they required replacement.	Dan Croisant	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing
2017-2019	Investigate NG shutdown in Kitchen to stop EF operation.	To be determined.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant	This work has not been completed yet.	This is an ongoing initiative.	Ongoing
2017-2019	Investigate ZEI Phoenix System optimization.	Monitor building level submeters for applicable variations in utility consumption.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	Received pricing to upgrade the existing macro server and system audit ($50,000), add occupancy sensors to existing system ($40,000), and retro-commissioning ($25,000).	Project requires funding source to move forward.	Ongoing
2017-2019	UNC Asheville is currently participating in a solar support program with AASHE to identify feasibility and potential funding sources for a total solar PV installation of 1 MW.	Not applicable.	To be determined.	Ongoing as funding through operating budget allows.	Dan Croisant Sonia Marcus	Due to regulatory restrictions, this project has been suspended.	Not applicable.	Not applicable.
2019-2021	Install ceiling fans in the Sherrill Center (SHE), Justice Center (JUS), and Student Recreation Center (SRC) to improve air circulation, promote homogenous space temperatures, increase occupant comfort, and reduce energy costs.	Building level submetering.	Fan manufacturer estimate of 10-15 year payback.	SHE - $65,000 JUS - $50,000 SRC - $45,000	Dan Croisant	No funding sources were available this last plan cycle.	Project requires funding source to move forward.	Unknown

Outreach

To have an effective energy management program, it is imperative to engage the end-users and get them involved in the process. Strategic initiatives within this area have been identified for implementation to educate and engage the end-users on campus to become active participants in the process of conservation.

Plan Year Initiated	Initiative	Measurement	Savings	Cost & Funding Source	Assigned to	Progress	Continued Work	Plan Year Closeout
2017-2019	Continue investigations into a University created Energy Dashboard.	Not applicable.	Not applicable.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing
2017-2019	Review training provided to students on how to operate their room's mechanical systems.	Not applicable.	Not applicable.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small Vollie Barnwell	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing
2017-2019	Reinstitute annual presentations open to the campus concerning the University's energy and water consumption.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing
2017-2019	Provide tutorials on the Campus Operations website, and/or Energy Dashboard, on how to utilize the various functions of the thermostats on campus.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes Jay Small	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing
2017-2019	Increase collaboration with other Universities, technical colleges, and public institutions within Western North Carolina.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes	There was a meeting hosted in Asheville, attended by energy managers and building operators for the Universities in the WNC Region.	Continue this collaboration with Universities within UNC Asheville's climate zone.	Ongoing
2019-2021	Reach out to University customers (Athletics and Events) to discuss their spaces, how they operate, limitations, etc.	Not applicable.	To be determined.	No project costs identified beyond staff salary.	Dan Croisant Robert Forbes	This is an ongoing initiative.	This is an ongoing initiative.	Ongoing

The University of North Carolina at Chapel Hill

Strategic Energy & Water Plan – FY22/23

Prepared by Cynthia Register

UNC Facilities, Engineering Services, Energy Management

8/31/21

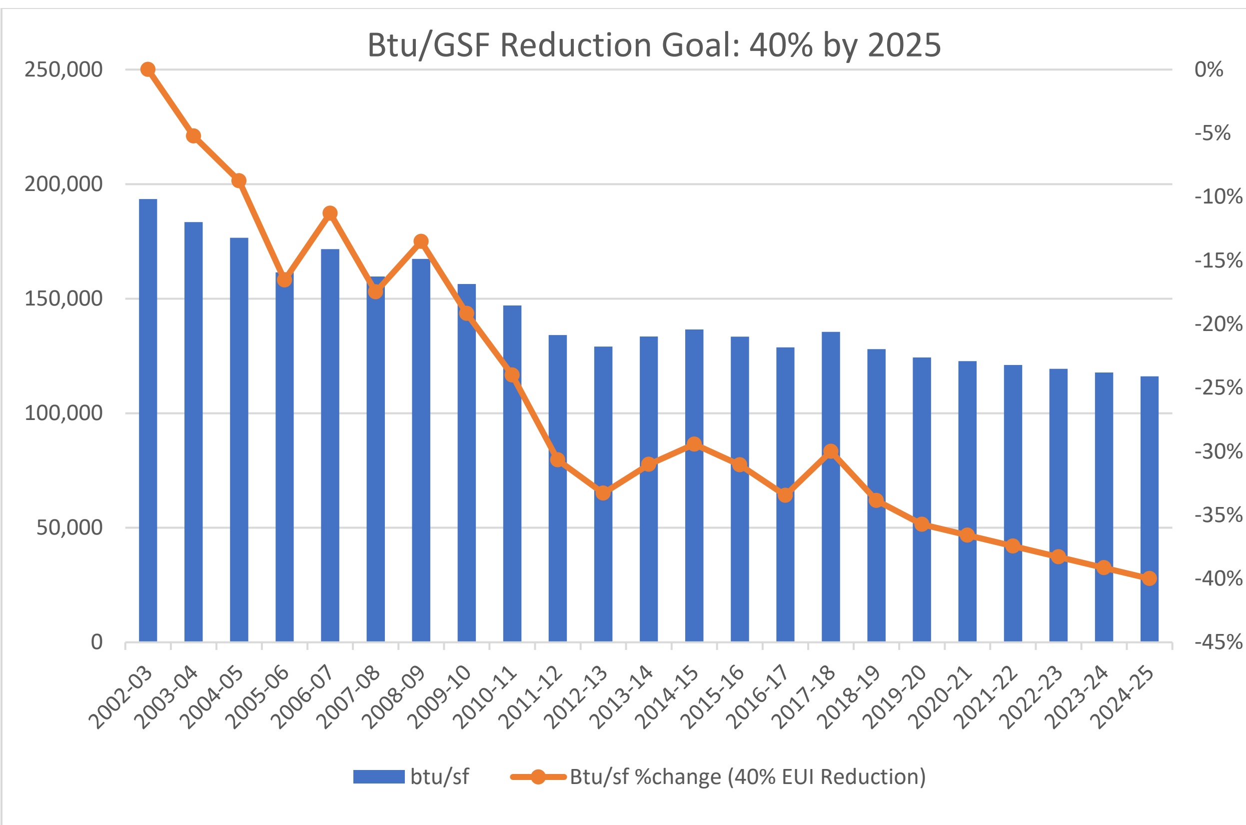
THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Overview

The Strategic Energy and Water Plan is a requirement of NC GS 143-64.12. (a). This legislation includes a past goal of 30% reduction of energy consumption per gross square foot for all State buildings by 2015 based on energy consumption for FY2003. UNC-CH achieved this mandated goal and has continued to show annual energy reductions ranging between 31% and 37%. These efforts have resulted in an impressive $524M of cumulative avoided energy cost since FY2003 for UNC-CH.

To encourage increased energy savings, the UNC University System has established a new goal of 40% reduction of energy consumption per gross square foot by 2025 based on energy consumption for FY2003. This is a voluntary goal with no current legislative requirements. This goal aligns with the Governor's Executive Order 80, requiring a 40% reduction of energy consumption for all Cabinet Agencies. The goal also aligns with filed HB 330 (2019-20 Session) that remains in committee review. The purpose of the Strategic Energy and Water Plan is to identify strategies for achieving the 40% reduction goal; including outreach programs, energy conservation measures, design guidelines, and alternative energy sources. The plan also includes cost estimates and energy savings analysis.

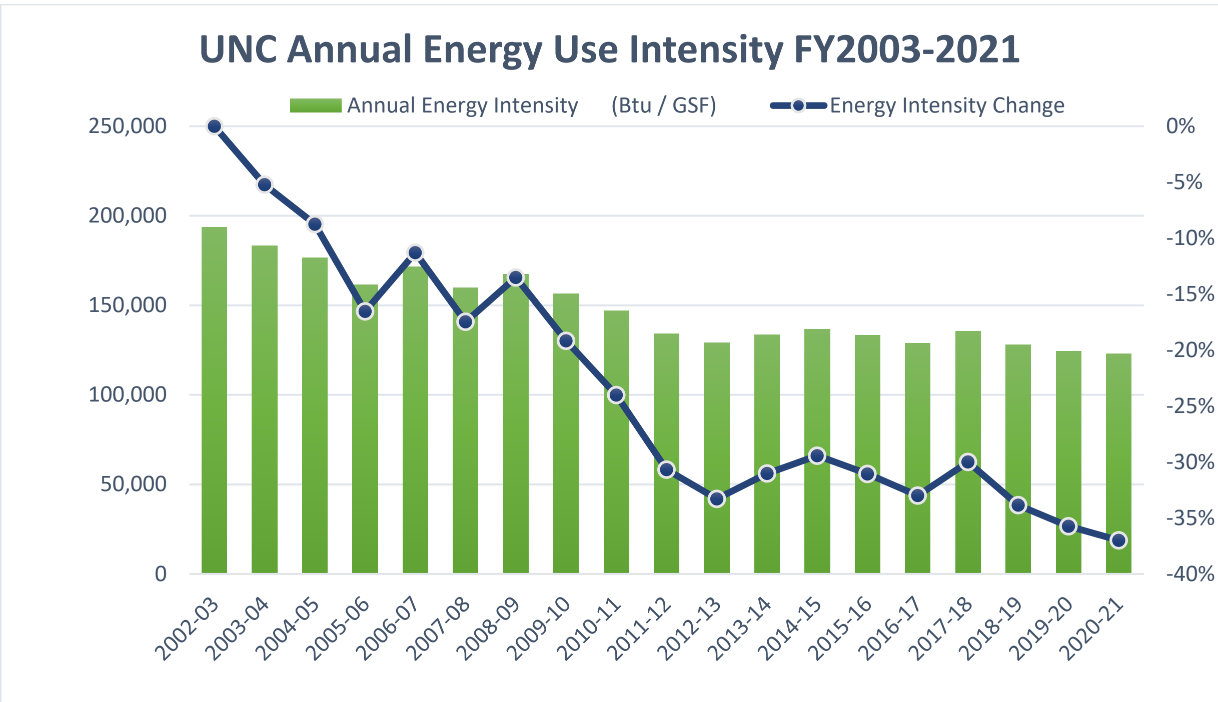
The graph below demonstrates the campus btu/gsf to achieve the 40% reduction goal.

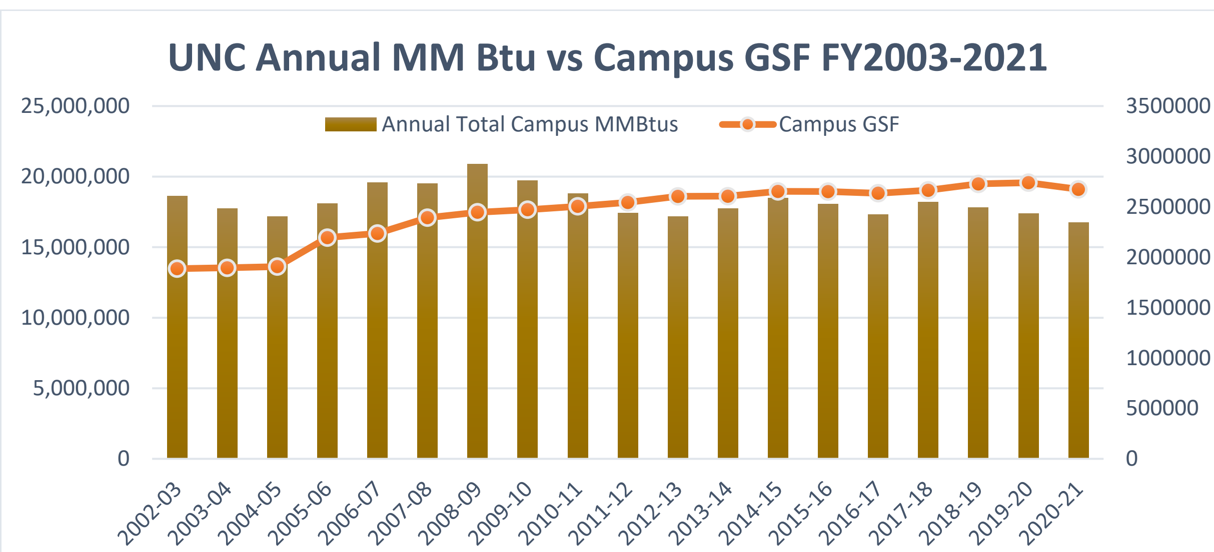


FY21 Energy and Water Report Metrics and Trends

Energy Usage

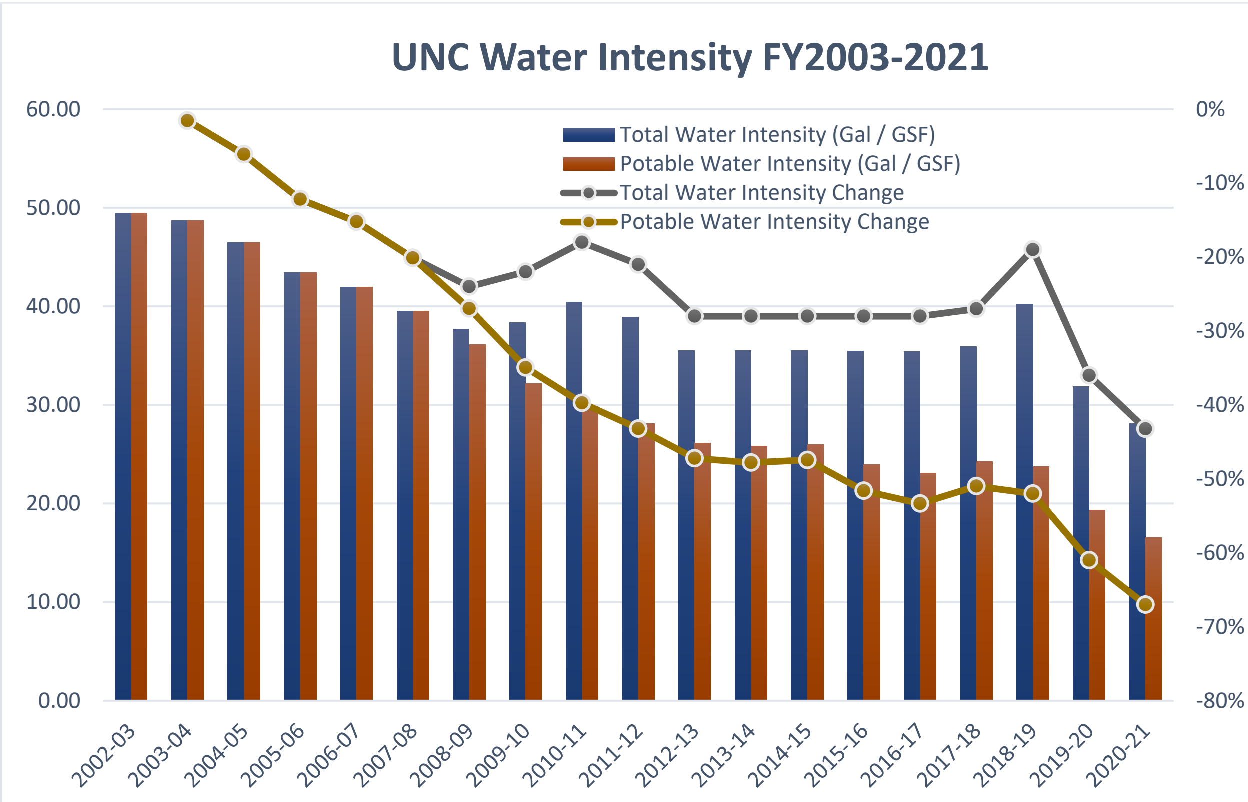
For FY21 Energy and Water Reporting, the University of North Carolina at Chapel Hill campus consisted of 408 buildings with a combined building area of 19,099,722 gross square feet. For FY21, the total campus energy consumption is 2,346,170,847,602 Btu. Energy consumption per gross square foot is 122,838 Btu/GSF; a 37% decrease from FY03 energy consumption of 193,500 Btu/GSF. For base reporting year FY03, the total energy consumption was 2,607,959,528,644 Btu for a campus size of 13,477,719 GSF. Although the campus has experienced a building GSF growth of about 42% since FY03, the overall campus energy consumption has decreased by 10%





Water Usage

Potable water use for FY21 is 316,123,000 gallons. Potable water consumption per gross square foot is 16.55 gallons/GSF; a 67% decrease from FY03 potable water consumption of 49.48 gallons/GSF. The reduction in potable water use is a result of increased use of non-potable water from the Reclaim Water utility on campus and the use of captured rainwater and condensate from cistern storage. The Reclaim Water utility became available in FY09 and use of this utility has increased from 27,054 gallons in FY09 to 220,442 in FY21. The Covid Pandemic has also impacted water consumption on campus contributing to reductions in overall water use, both potable and non-potable due to reduced campus occupancy.



FY21 Strategies/Impacts

Pandemic Impact

The COVID-19 pandemic continues to have varying impacts on energy consumption related to on-campus occupancy and heightened awareness of importance of good building ventilation. Although the campus has a full re-opening in July 2021, a portion of campus staff continued to work in a hybrid arrangement of on-site and off-site. Facilities is continuing to address ventilation concerns and has implemented outside air damper replacements and repairs in about 20 buildings. Building operation practices continuing from FY21 are relaxed building schedules to allow for increased flushing of air prior to and following occupancy each day; and for areas with higher risk activities, outside air ventilation has been increased or supplemented with portable HEPA filtration units. UNCCH also increased filtration level to MERV13 or higher for main air handling equipment that have box filters. Energy Management has not attempted to calculate any energy consumption changes related to these changes.

Ongoing Initiatives

Low Cost ECMs and Monthly Monitoring of Building Energy Use. Energy Management has implemented low cost ECMs in 150 major buildings on campus. These 150 buildings represent about 12,000,000 GSF or about 62% of the total campus GSF. Energy Management generates monthly energy forecast reports for these 150 buildings to identify higher than expected energy use by utility allowing for more timely intervention. Maintenance issues are addressed through the maintenance work order system. Other continued low performers are targeted for retro-commissioning opportunities, including improved control sequences, tuning of control loops, and calibration of sensors. Based on our forecasting model for FY21, this initiative contributed to an avoided energy cost of $2.2M and avoided energy usage of 61,484,291 kBtus.

Winter Break. The University conducted its annual Winter Break Saving Initiative that focuses on aggressive scheduling of buildings during the 9-day campus closure (Dec 23 – Dec 31).

Target EUIs for Buildings by Type. Energy Management participated with a UNC capstone project in FY20 to establish target EUIs for each of the building types on campus. This will be another energy analysis tool that will help identify low energy performers and creating a more targeted and coordinated approach to defining and implementing ECMs in low performing buildings. Energy Management is also hoping this will be useful tool in selling the value of including energy improvement components in capital projects, including Repair and Renovation projects. Energy Management is planning to make greater use of this analysis during FY22.

New Building Construction/Major Building Renovation. New buildings and major building renovations on campus require designs to meet the Performance Standards for Sustainable, Energy-Efficient Public Buildings (NCGS 143-135.35-40). Designers are required to model the buildings for energy performance and to evaluate life cycle costs of building/energy systems that result in energy savings over life of the building. The UNC team is actively engaged with energy performance throughout the design and construction process, including comprehensive commissioning of the building envelope, building HVAC control systems, and building electrical systems. The Medical Education Building is still under construction (Target Completion in late fall 2022) with a designed EUI target of 104. This target EUI falls within our campus target EUI of 116 to meet the 2025 goal.

Campus Engagement. Energy Management is actively engaged in many outreach programs on campus, including participation in new student orientation, Green Labs, UNC Housing Sustainability, UNC Three Zeros, RESPC Student Green Fee Organization, student Capstone projects, and student interns through the EcoStudios program and the Sustainable Triangle Field Site (STSF) programs. The programs allow Energy Management to educate campus partners about energy savings opportunities and to assist groups with implementing changes that result in energy reduction. It would be very challenging to calculate energy savings specific to these efforts; however, Energy Management believes engaging with campus partners is impactful and helps gain support of other initiatives.

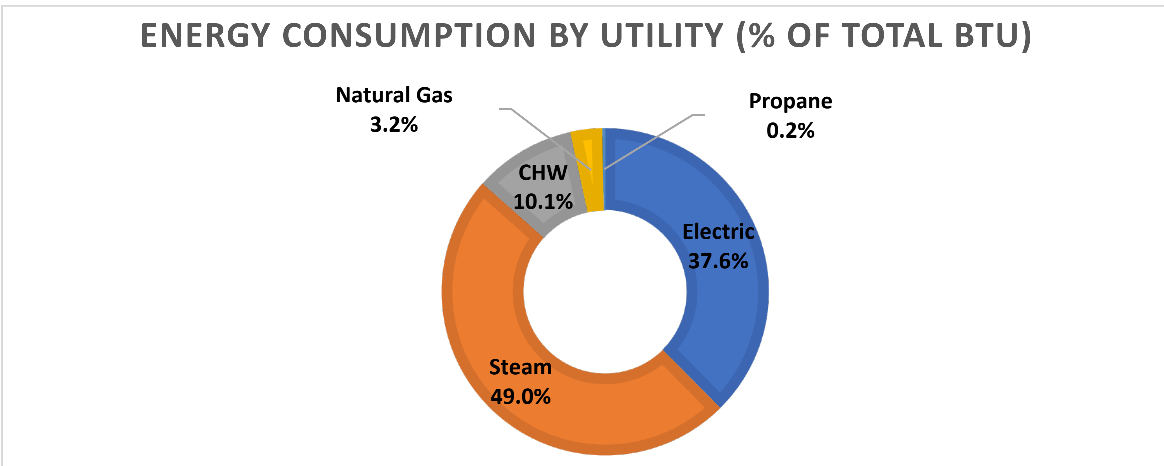
Energy Projects

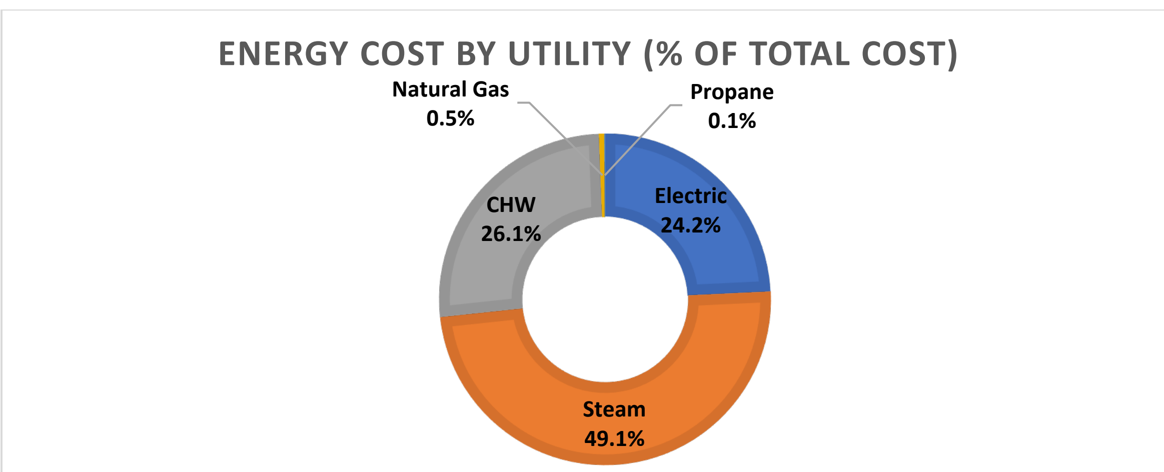
For FY22, UNCCH is utilizing 1292 funds to implement two energy projects: Thurston Bowles Air Flow Reduction and Taylor Air Flow Reduction. As part of a revised budget model, Energy Management is hoping to have access to annual 1292 funds to target energy projects.

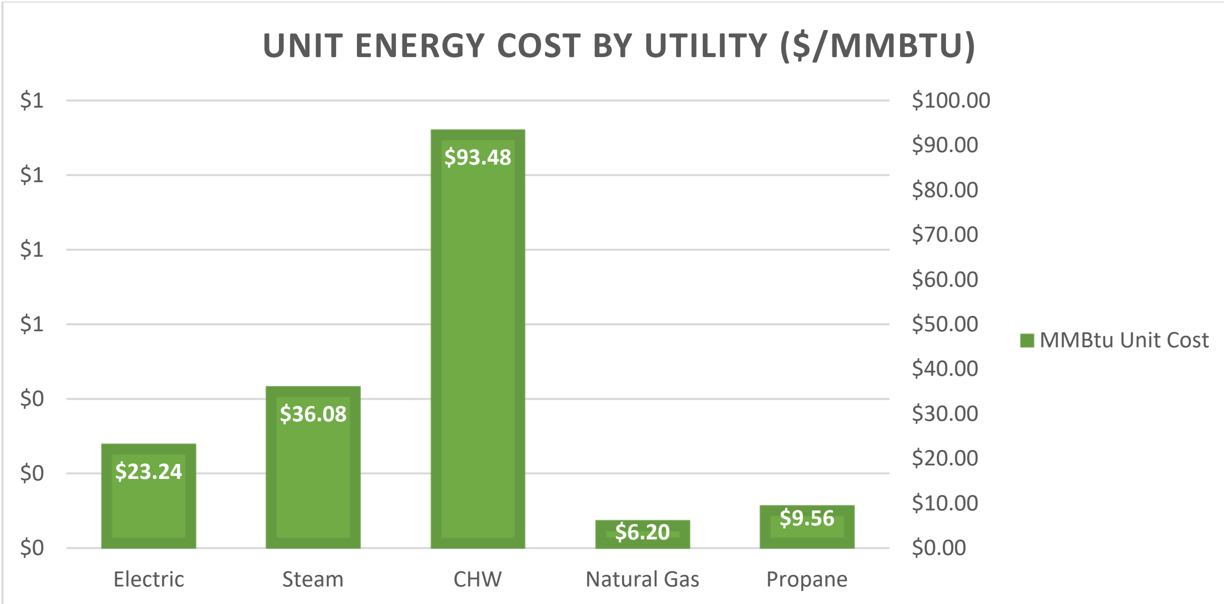
Campus Utilities

Energy

Consumption and Cost by Energy Type. Energy on the UNC-CH campus is supplied by UNC Energy Services and consists of electricity, district chilled water, district steam, natural gas, and propane. The campus electricity is sourced from Duke Energy Carolinas and the UNC Co-Gen plant. Each utility is metered at the building level with a few exceptions for steam to hot water convertors that serve multiple buildings. Energy Services establishes the billing rates for these utilities. For FY21 energy consumption by category, cost, and unit cost are demonstrated in the following graphs.







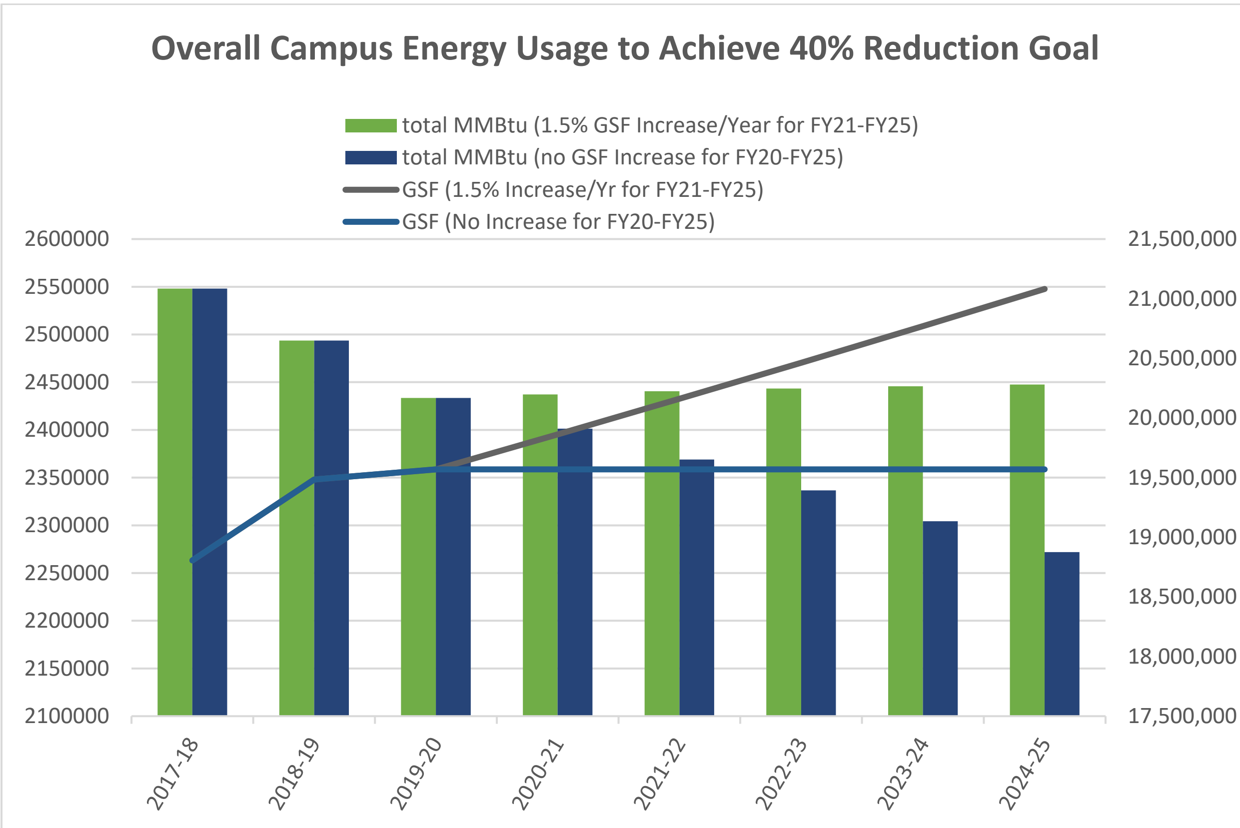
Renewable Energy Projects. Energy Services has several active renewable energy projects. The largest of these active projects is the installation a ground mounted solar array, 376kWac. The planned battery storage component of the project has been removed from the current scope due to budget constraints. Project includes provisions for future battery storage. This project is sited on the Carolina North campus and connected to the electric grid that supplies power to the current north campus buildings. The other two renewable projects are the more traditional rooftop solar arrays planned for Friday Center (70.7 kW) and the Carroll Hall Addition (25.2 kW) projects. These two projects are being funded through RESPC, the student green fund organization. The Kenan Flagler Business School is actively seeking renewal energy options as part of the design of the Business School Addition. The design team is pursuing an aggressive EUI target of 46.4 with expectations of further reductions from use of rooftop solar, an estimated 484kW combined.

Water

Water, reclaim water, and sanitary sewer utilities are provided OWASA (Orange Water and Sewer Authority); however, these utilities are managed and billed by UNC Energy Services. In FY20, OWASA provided UNC-CH with water analytic software, Auqa Vista, that provides interval water use data that can be trended and used for notifications, including leak detection. Energy Services and Energy Management have started using this analytic tool to provide earlier detection of leaks and to identify high water consumers in different user categories. This tool appears to have good potential for providing timely information that can lead to decreased water consumption. Energy Services and Energy Management have partnered with student interns over the past three semesters to perform some initial analysis of the data.

FY25 Goal of 40% Reduction in Energy Consumption per GSF

The FY25 goal of 40% reduction in energy consumption per gross square foot from base year FY03 is equivalent to 116100 Btu/GSF and represents an estimated $52.7M avoided energy cost for FY25. Considering a campus growth of 1.5% per year, the overall campus Btu in FY25 must not exceed 2,473,464 MMBtu to meet the goal of 116100 Btu/GSF. Graphs below show projections and values to meet the FY25 goal.



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In identifying strategies to achieve the 40% goal, this report assumes no increased building SF as a conservative approach in establishing the required reduction in energy usage. Even though the ongoing initiatives listed earlier in the report will still be pursued, this section identifies specific efforts and projects.

Strategies

LED Lighting Upgrades. UNCCH is continuing to convert campus lighting to LED. LED fixtures are standard for new construction, including small upfit projects across campus. Exterior lighting has been a prime focus with about 97% conversion to LED lamps. Work on a Campus LED Master Plan has been deferred because of limited staff resources although specific projects are still being pursued. UNC Transportation has a LED Master Plan for Parking Decks and Surface Lots and multiple LED lighting retrofit projects in design and construction. Three parking decks are nearing completion and are shown in the FY21 list of projects. LED lighting is planned for a fourth deck and that project is being shown in FY22. The completed LED lighting projects for the parking decks have demonstrated significant energy savings of about 50%. Other LED lighting retrofit projects being planned are conversion of T5 fluorescent to LED and T8 fluorescent to LED. Energy Management has mentored several student interns that evaluated LED retrofit projects. In the current product market, their evaluation indicated the use of LED direct replacement lamps in newer fixtures provided the shortest payback period and allowed for flexibility of installation by in-house staff. Several of these type of LED retrofits appear in the project list across all years.

Focus on Steam Use Reduction in Lab Buildings. Steam use on the UNC campus accounts for almost 50% of the campus energy consumption and about 50% of the campus energy cost by utility. Since it is also a significant contributor to GHS emissions, focus on reducing use of this utility has good potential for energy savings and GHG emission reductions. The UNC campus supports significant research in energy intensive laboratories. About one-third of the campus steam usage is consumed by 20 of these laboratories. Current efforts to reduce steam usage in these buildings include retrofitting steam sterilizers (autoclaves) with scheduling programs, identifying steam stills that can be replaced with more energy efficient RO/DI systems, and checking for leak by on steam valves. UNCCH also operates an in-house steam trap inspection and repair program that inspects each building once per year. Energy Management estimates these efforts will result in 10% reduction in steam usage for 22 targeted lab buildings, representing about 23,770 MMBtu of steam reduction. The autoclave retrofit with scheduling function is being funded by the student green fee group (RESPC). Autoclave scheduling retrofits have been completed in three lab buildings with a measurable impact.

Airflow Reduction in Lab Buildings. Many of the older research labs on campus are operating with air change rates in excess of 9 air changes per hour (ACH). This ventilation rate requires a tremendous amount of energy to heat/cool/dehumidify the single pass outside air requirement. Current lab standards consider 6 ACH to provide for safe working environments. Energy Management and Environmental Health & Safety have been partnering to identify labs where airflow reduction projects are feasible and impactful on energy use reductions. For FY22, UNCCH is pursuing 1292 funds for implementing two airflow reduction projects: Thurston Bowles and Taylor Hall. The Covid Pandemic has greatly impacted manufacturing and supply chains resulting in significant project cost escalations creating continued holds on some projects, including Chapman Air Flow Reduction and three future projects planned for Lineberger, Glaxo, and Fordham. The two current projects represent an estimated energy reduction of 24,532,462 kBtu and the four planned projects an estimated reduction of 29,339,481 kBtu.

Expanded HVAC Scheduling in Athletic Buildings. Athletic buildings have sporadic occupancy scheduling based on nature of the activities occurring is these buildings. As such, it is very challenging to establish fixed occupancy scheduling for HVAC equipment setbacks and shutdowns. Energy Management is investigating opportunities to use interactive occupant scheduling tool that providing scheduling information to the BAS to establish unoccupied hours for these buildings. Events to HVAC is one brand of this type of occupant scheduling tool and it is being successfully used at the Student Activity Center on campus. As Energy Management develops more detailed scope, these projects/initiatives will be added to each years project list.

HVAC Building Controls Upgrades. A significant number of buildings on campus have outdated HVAC controls systems. The oldest of these are pneumatic control systems with no remote visibility. There are also older direct digital control (DDC) based systems that are outdated and no longer supported by the vendor. These older software systems are also not compatible with newer Windows operating systems and are presenting numerous IT challenges. UNCCH has partial finding to implement this upgrade and although design work started in FY21, progress has been slow due to several bidding challenges, including impacts of Covid pandemic. Installation of updated controllers, gateways, and software provides expanded opportunities for energy savings through programming of the building automation system, enhanced trending, and enhanced remote graphics. As Energy Management develops more detailed scope, these projects/initiatives will be added to each years project list.

FY21 Project Status

FY21	Reduction in Usage - Calc from Metered Consumption					
Steam Reduction Initiative	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
10% Steam Usage Reduction - 22 Target Buildings	18,264			23,769,865,440	NA	on going
HVAC Projects						
Marsico RetroCx	-1,211	614,251	1,053,034	3,379,169,816	Note 3	complete
LED Lighting Projects					$974,000	
Business School			335,892	1,146,063,504		complete
Cobb Parking Deck			232,512	793,330,944		complete
Rams Head Parking Deck			492,348	1,679,891,376		complete
Berryhill Demolition	20,315	2,313,095	2,927,200	41,556,748,391	Note 2	complete
				72,325,069,471	$974,000	
Notes						
1. Steam reduction will focus on repairs and calibrations many to be accomplished through maintenance budget						
2. Berryhill, EUI 532, will be replaced by Medical Education Bldg, modeled EUI 104, currently under construction. The EUI of 104 falls within the 40% goal.						
3. Scope is included in larger capital project that is currently funded. Cost breakout NA at time of this report.						

FY22 Projects

FY22	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Thurston Bowles - Air Flow Reduction	5160	1272413	3009847	19,789,723,223	$2,477,000	Funding Approved - FY22 1292
Taylor - Airflow Reduction	1378	339677	644967	4,742,739,023	$1,658,000	Funding Approved - FY22 1292
LED Lighting Projects						
Jackson Parking Deck			241516.8	824,055,322	$500,000	Funded by Parking & Transportation
Steam Reduction						
Autoclave Scheduling	2,309	103,402	312,065	4,297,750,645	$77,000	Pending Approval - Possible Student
				29,339,481,647	$4,712,000	

FY23 Projects

FY23	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Lineberger - Airflow Reduction	8229	439168	487405	13,340,733,226	$2,420,750	Targeting FY23 1292 Funds
MBRL/Glaxo - Glaxo Airflow Reduction	3128	198196	294237	5,511,757,634	$1,208,600	Targeting FY23 1292 Funds
Chapman Air Flow Reduction	6,798	688,383	1,042,670	13,922,215,886	$400,000	Targeting FY23 1292 Funds
LED Lighting Projects						
Genetic Medicine: T5 Fluorescent to LED			839020	2,862,736,240	$190,000	Targeting FY23 1292 Funds
				35,637,442,986	$4,219,350	
Notes						
1. The lighting projects are LED direct lamp replacements for T5 and T8 florescent tubes in existing fixtures performed by in-house staff. These costs are estimated from electrical plans and a future field survey is required for more accurate scope and cost estimate prior to funding projects.						

FY24 Projects

FY24	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
Fordham Hall - Controls Upgrade & Airflow Reduction	875	215694	980260	4,958,846,981	$1,458,340	Targeting FY24 1292 Funds
Carroll Hall - VAV Zone Control Upgrades	535	182365	128773	1,537,614,755	$670,000	Targeting FY24 1292 Funds
Tate-Turner-Kuralt - Add VFDs to HW System			17141	58,485,092	$18,000	Targeting FY24 1292 Funds
Tarrson - Controls Upgrade	147	50027	110851	679,805,344	$78,000	Targeting FY24 1292 Funds
LED Lighting Projects						
House Undergrad Library			596951	2,036,796,812	$62,300	Targeting FY24 1292 Funds
Health Sciences Library			563890	1,923,992,680	$78,400	Targeting FY24 1292 Funds
Sitterson			1566960	5,346,467,520	$410,000	Targeting FY24 1292 Funds
				16,542,009,185	$2,775,040	
Notes						
1. The lighting projects are LED direct lamp replacements for T5 and T8 florescent tubes in existing fixtures performed by in-house staff. These costs are estimated from electrical plans and a future field survey is required for more accurate scope and cost estimate prior to funding projects.						

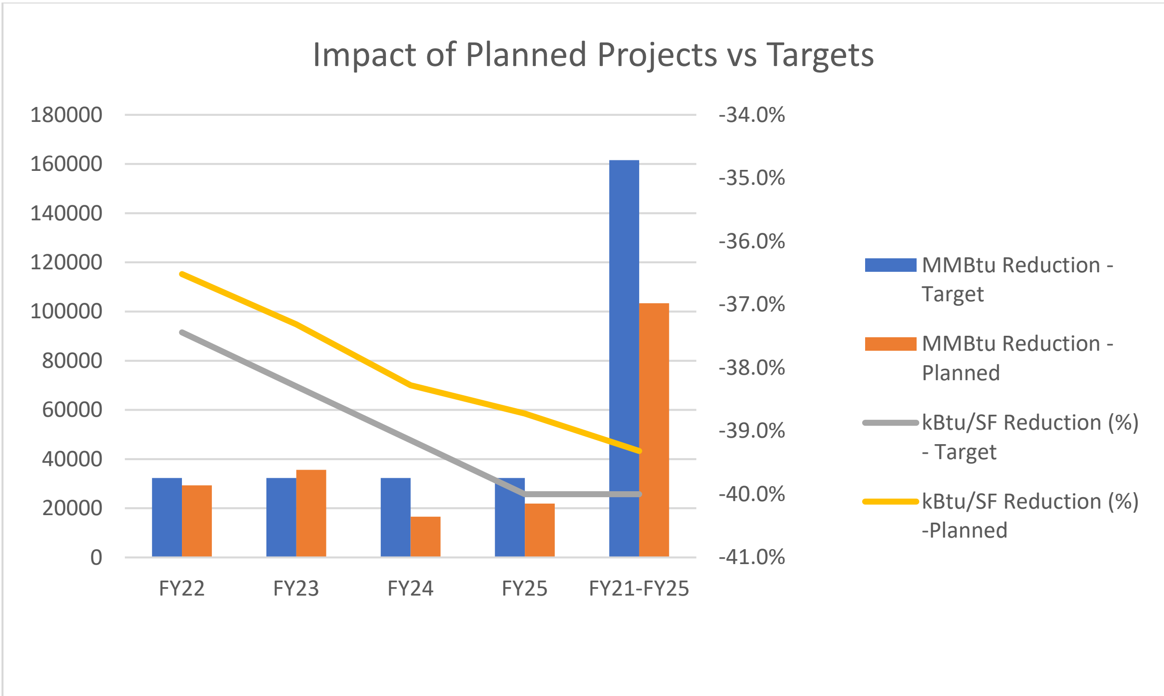
FY25 Projects

FY25	Reduction in Usage					
HVAC Projects	**Steam (klbs)**	**CW (ton-hrs)**	**Electric (kWh)**	**Btu Reduction**	**Project Cost**	**Status**
McGavran Greenburg - Heat Recovery Replacement	1972	26261	-53122	2,443,110,092	$492,000	Targeting FY25 1292 Funds
Genome Science RetroCx	1536.2	287542.1	689685.4	4,986,295,932	TBD	Targeting FY25 1292 Funds
Kenan Labs - Airflow Reduction (Lower Floor)	3364	335491	223506	5,880,187,071	TBD	Targeting FY25 1292 Funds
Chapman - Auditorium Systems Energy Reduction	167	24653	27540	365,649,259	TBD	Targeting FY25 1292 Funds
Koury Oral Health RetroCx	972.1	166608.3	8330.415	1,660,802,660	TBD	Targeting FY25 1292 Funds
LED Lighting Projects						
Admin Office Bldg			845559	2,885,047,308	$200,000	Targeting FY25 1292 Funds
EHS			156366	533,520,792	$19,600	Targeting FY25 1292 Funds
MBRB			728791	2,486,634,892	$102,200	Targeting FY25 1292 Funds
New East			189314	645,939,368	$26,500	Targeting FY25 1292 Funds
				21,887,187,373	$840,300	
Notes						
1. The lighting projects are LED direct lamp replacements for T5 and T8 florescent tubes in existing fixtures performed by in-house staff. These costs are estimated from electrical plans and a future field survey is required for more accurate scope and cost estimate prior to funding projects.						
2. Project scope and cost estimates to be further developed during FY22.						

Conclusions

The Strategic Energy & Water Plan is a working document designed to provide guidance in reaching the University's goals for reduced energy use intensity and water use intensity. The plan is designed to be easily updated and flexible so that initiatives can be modified in response to changes in the University's capital program and in response to changes operations on the University campus.

With the current and future planned projects/initiatives identified in this plan, UNCCH will be close to achieving the 40% goal for FY25. Energy Management is continuing to develop projects/initiatives and to seek funding approval as required to implement. In addition, Energy Management is continuing its on-going monitoring and retro-commissioning efforts in-house to maximize low cost opportunities for energy and water savings. The savings results of these efforts will be captured in each annual update of the Plan. The graph below illustrates the impact of planned projects identified in the previous tables.


Impact of Planned Projects vs Targets
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
-34.0%
-35.0%
-36.0%
-37.0%
-38.0%
-39.0%
-40.0%
-41.0%
FY22
FY23
FY24
FY25
FY21-FY25
MMBtu Reduction - Target
MMBtu Reduction - Planned
kBtu/SF Reduction (%) - Target
kBtu/SF Reduction (%) -Planned

UNC GREENSBORO
Facilities Operations

2021 Strategic

Energy and Water Plan Annual Report

August 26, 2021
Facilities Operations
Prepared by: Nihal Raees

UNCG Nursing and Instructional Building December 2020

I. OVERVIEW

The University of North Carolina at Greensboro (UNCG) has implemented energy efficiency initiatives, a renewable energy installation, and educational programs about the benefits of energy conservation in a concerted effort to reduce energy consumption. Through implementation of the UNC System's first performance contract, installation of several new technologies, improvements to the steam and chilled water infrastructures, and education and outreach efforts, energy and water consumption at UNCG have decreased significantly since the baseline year FY2002-2003 designated by the State. This report provides a top-level description of the campus utilities infrastructure and an update on campus progress towards utility reduction goals with projects already implemented and those planned for next year.

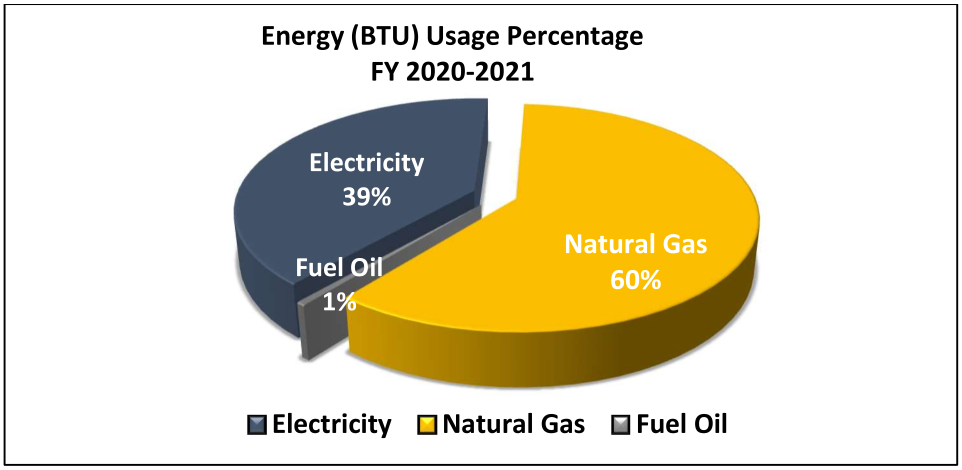
UNCG continues to reduce utilities consumption and expenditures despite the changes in student counts and campus building square footage. UNCG is currently at 99,942 EUI BTU/GSF, a 21% reduction from the baseline year 2003. Full Time Equivalent FTE student enrollment in general has increased from approximately 12,000 in the baseline year to over 18,000 full-time equivalent students in 2020. Due to COVID -19 pandemic however, FY2021 recorded lower student population 17,811 FTE, a 2% enrollment drop than the prior fiscal year. The campus footprint on the other hand recorded 58% increase 2.5 million additional indoor spaces than the baseline level. In FY 2021. UNC Greensboro added two new constructed buildings using Connect NC Bond. Those two buildings are South Chiller Plant with 3,000 cooling ton current capacity, and a five-story facility Nursing and Instructional Building NIB. This facility has 39 labs, 14 classrooms, nine research suites, and a community engagement center to host the Nursing School, the School of Health and Human Sciences, and the Departments of Biology and Chemistry. The two new facilities totaled 195,825 GSF included in FY2021 campus indoor footprint.

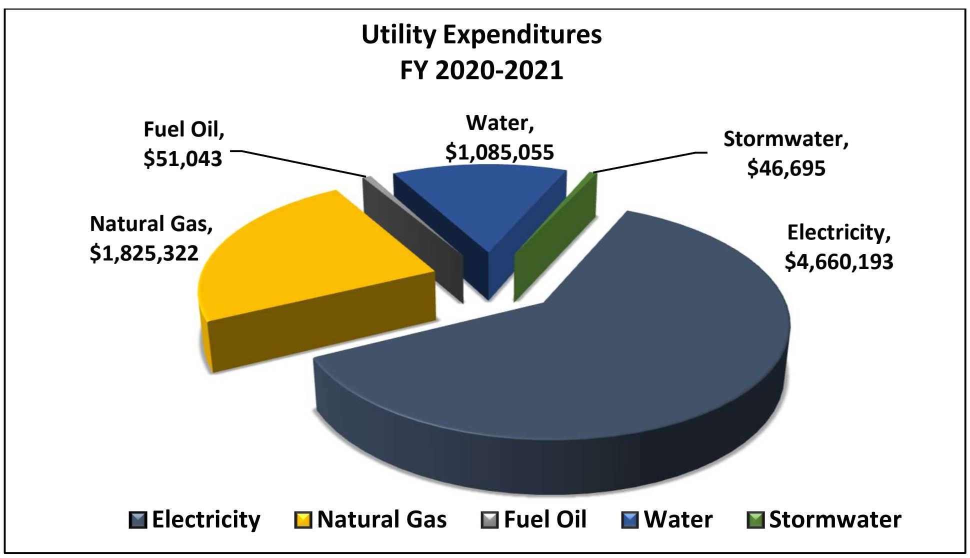
II. SUMMARY OF FISCAL YEAR 2020-21:

- The University's total utilities expenditures for FY2020-21 was $ 7.67 million (Electricity: $ 4.66 million for 77.77 million kWh; Natural Gas: $ 1.83 million for 4.04 million therms; Water: $ 1.13 million for 116 million gallons of water; and $ 51, 000 for using 26 kgal of #2 fuel oil). FY2021 utilities expenditures was flat with the prior year showing 0.4% reduction and $280,000 fewer dollars difference.
- UNCG accepted two new facilities part of $105 million Connect NC Bond project. Those are South Chiller Plant SCP (9,821 gsf) accepted on Sep 16, current capacity 3,000 cooling ton, that was designed for five chillers 7,500-ton ultimate cooling load. Second building is Nursing and Instructional Building (NIB) 186,004 GSF accepted on Dec 10, 2020. That required Facilities operational personnel to learning about those new facilities and work together for a meaningful commissioning process.
- The NIB has 23 kW (AC) capacity Solar Photovoltaic system. The Designers estimated the system generates 48,000 kWh annual to support 2.3% of building estimated annual (2.1 million) kWh usage. Currently NIB's solar system provides the building with 3,000 to 4,000 kWh monthly. NIB facility is LEED certified, that add up with other same category building to 26% of total campus GSF as LEED Certified, breaks down to 12% LEED Silver, 9% LEED Gold.
- In response to COVID-19 special operation hours seeking to cut utility consumption and cost, the energy team frequently adjust as needed setpoints, HVAC dampers, and occupied/unoccupied schedules and settings in buildings systems to provide safe environment and cut as possible in utilities cost.
- UNCG continues as resources available to upgrade to LED remaining fluorescent, T12, metal halide, and incandescent lamps. In FY2021, in addition to Building and Trades personnel LED upgrade efforts in several buildings. To cut in lighting upgrade project's costs, USCF funds used to have the Electric Shop personnel upgraded to LED the entire Gatewood Studio Arts Building (112,000 GSF) lights. The project upgraded 2,900

F32 T8, 14 wall wash MH metal halide fixtures, over 300 halogen spotlights, and 163 pendant light fixtures in studio art open spaces in the third and fourth floors. The Electric Shop also completed Phase III of a multiyear student supported Green Fund grant to upgrade to LED 67 campus wide outdoor pole lights.

- In FY2021, the University expended the entire $872,169 Utility Savings Carry Forward HB 1292 amount. All the projects were managed by Facilities Operations to cut projects cost and time. Over $340,000 (40 % of total funds) was used to fix five substantial condensate leaks which some was identified from the last fiscal year. The rest of the USCF funds were used to perform Gatewood Studio Arts in-house LED upgrade, Steam Plant Controls enhancements, and supported replacing old/failing HVAC roof top units and equipment with new more efficient ones backing up Renovation and Repair R&R funds as needed.





III. UTILITY USAGE

UNC Greensboro currently stands at 99,942 BTU/GSF overall campus Energy Use Intensity (EUI), showing 21% reduction compared to the FY2003 baseline year. Although UNCG has not achieved the 30% EUI reduction State mandated goal in FY2015, the University has dropped below 100,000 BTU/GSF/year after starting at 125,992 BTU/GSF/year. FY2021 electricity, natural gas, and water total utility cost per campus square foot was 1.1 $/GSF showing 3% reduction from $1.2 in FY2020, and 12% reduction compared to 1.3 $/GSF in the baseline year.

FY2021 energy usage narrative:

- NIB new facility is served by campus infrastructure (steam, chilled water, electricity, and domestic water). Started July 2020, the building was partially conditioning until December when been fully and for 24/7 occupied when came online.
- Steam Plant main campus distribution system impacted steam production by five considerable condensate leaks. Plant makeup water increased from used to be around 12% to over 20% that resulted in additional therms usage to raise tap water temperature to 127F condensate level.
- Greensboro weather was colder than last year with 256 additional Heating Degree Days HDDs calling for extra therms

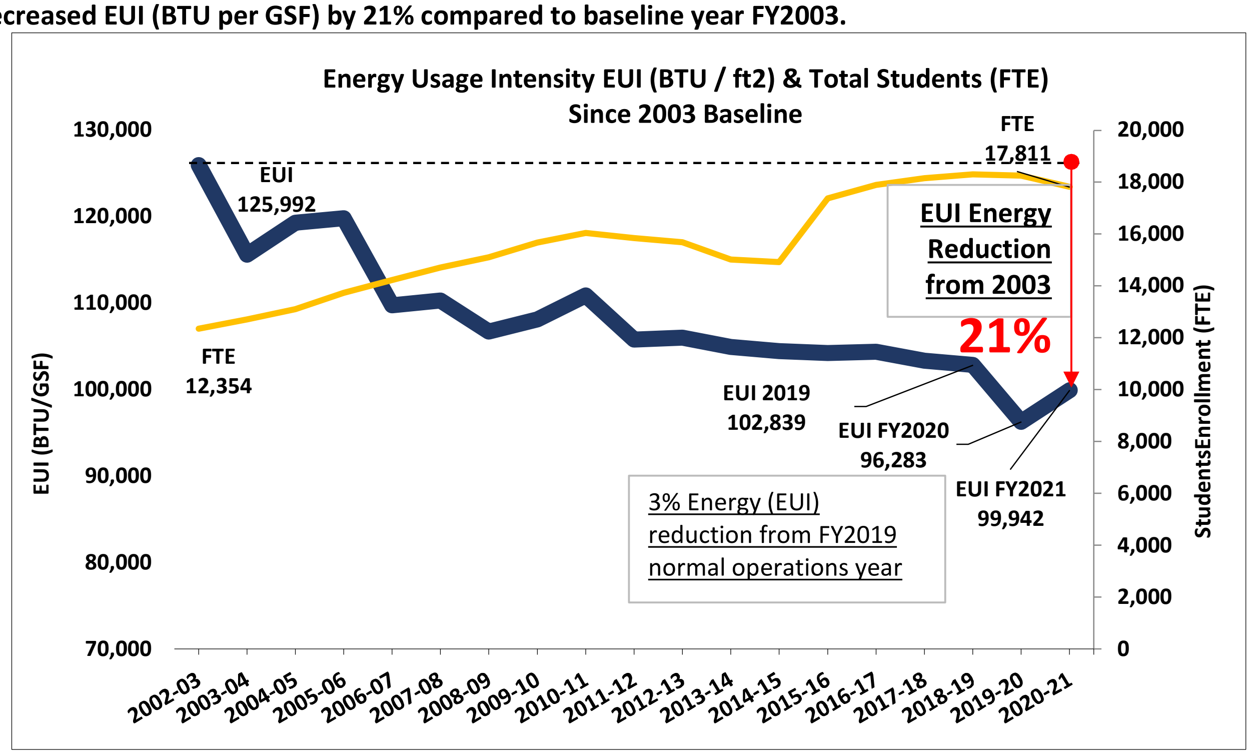
All what mentioned contributed to a 10% increase in therms usage over FY2020 consumption. In electricity usage, a new more efficient chiller plant SCP 3,000-ton supported campus cooling load along with the existing McIver Chiller Plant 6,000-ton. On the water side, FY2021 showed 11% water reduction over the prior fiscal year. The following was noted when compare FY2021 over the prior year water usage: new chiller plant SCP required additional amount of water to fill up cooling towers more than once until the plant was fully operated, NIB water load; and the Campus North Athletic Fields' irrigation load was carried by the city water for the entire fiscal year due to failure in well water pump that required replacing it with new motor.

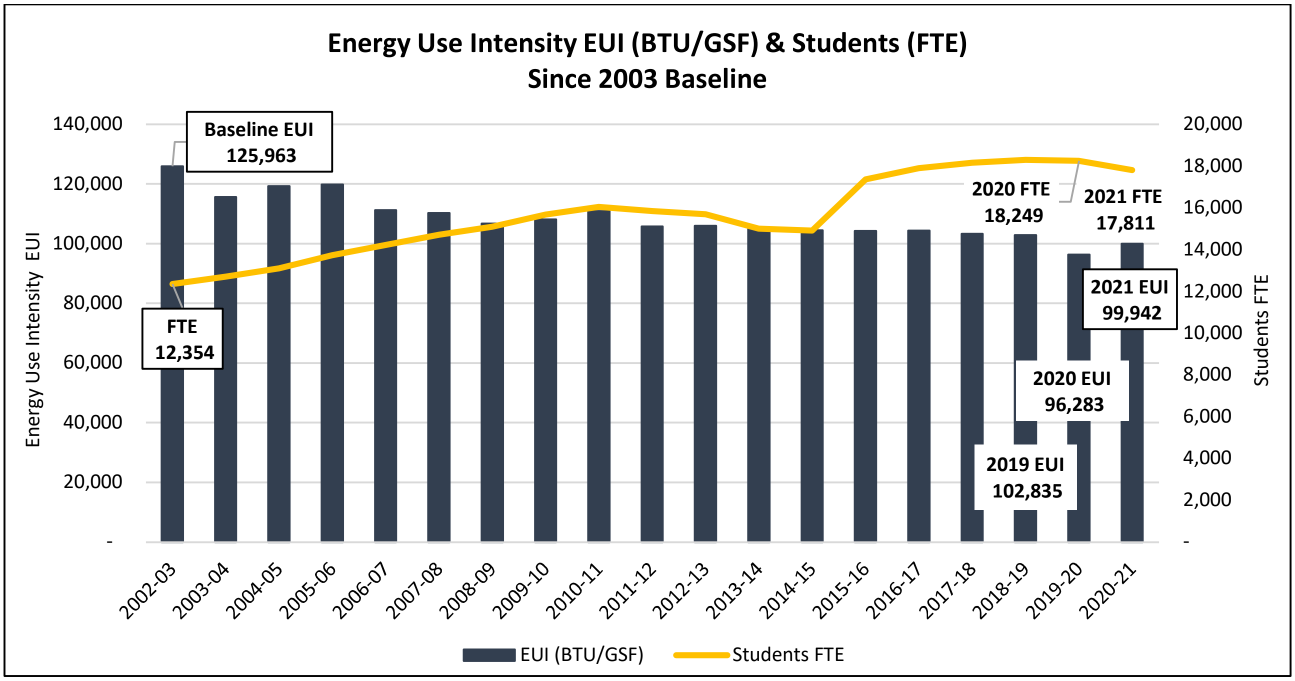
Fiscal Year	*Area*	*Utilities*	*Utility/Area*	*Energy*	*Energy/Area*	*Energy*	*Energy Cost*
	GSF	*$*	*$ / GSF*	*$*	*$ / GSF*	*MMBTU*	*$ / MMBTU*
2002-03	**4,269,699**	**5,537,461**	1.3	**4,990,987**	**1.2**	**537,824**	**9.3**
2003-04	4,942,520	6,085,348	1.2	5,527,654	**1.1**	571,384	9.7
2004-05	4,987,544	6,878,519	1.4	6,248,603	**1.3**	594,916	10.5
2005-06	5,177,689	8,455,503	1.6	7,622,474	**1.5**	620,424	12.3
2006-07	5,415,496	7,674,070	1.4	6,884,414	**1.3**	602,349	11.4
2007-08	5,415,496	8,500,093	1.6	7,593,983	**1.4**	597,302	12.7
2008-09	5,415,496	7,906,663	1.5	6,861,603	**1.3**	577,867	11.9
2009-10	5,415,496	7,713,099	1.4	6,530,241	**1.2**	585,475	11.2
2010-11	5,551,245	7,653,606	1.4	6,753,156	**1.2**	615,587	11.0
2011-12	5,510,548	7,402,485	1.3	6,663,983	**1.2**	582,985	11.4
2012-13	5,716,735	7,571,726	1.3	6,853,774	**1.2**	605,897	11.3
2013-14	5,999,437	8,034,092	1.3	7,234,731	**1.2**	629,295	11.5
2014-15	6,086,061	7,859,390	1.3	6,959,803	**1.1**	635,534	11.0
2015-16	6,163,784	7,776,021	1.3	6,783,434	**1.1**	642,376	10.6
2016-17	6,408,406	8,569,900	1.3	7,435,123	**1.2**	668,955	11.1
2017-18	6,531,155	8,621,691	1.3	7,521,794	**1.2**	674,606	11.1
2018-19	6,542,163	8,601,691	1.3	7,435,361	**1.1**	672,766	11.1
2019-20	6,586,747	7,739,359	1.2	6,554,646	**1.0**	634,193	10.3
2020-21	**6,737,988**	**7,668,308**	**1.1**	**6,536,559**	**1.0**	**673,406**	**9.7**
% Change FY 2021 to FY2020	2%	-1%	-3%	-0.3%	-3%	6%	-6%
% Change FY2020 to 2003	54%	40%	-3%	31%	-15%	18%	11%
% Change FY2021 to 2003	58%	38%	-12%	31%	-17%	25%	5%

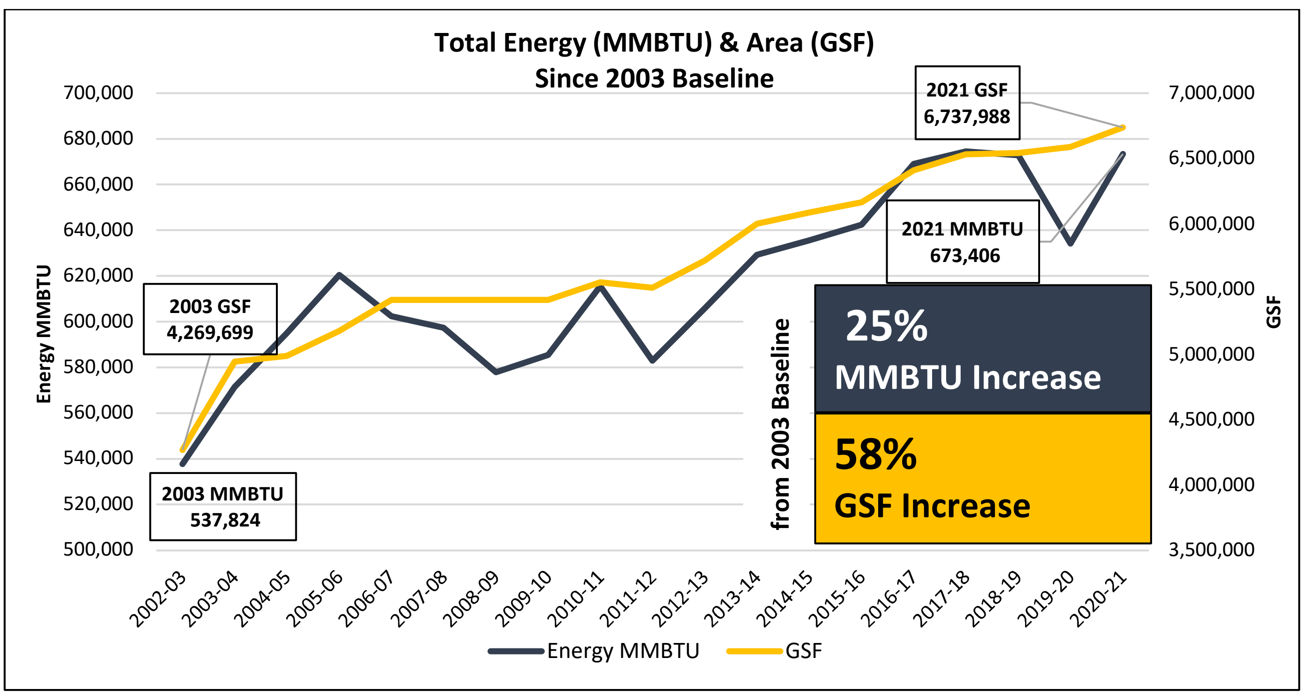
Key Performance Indicators (KPI).

Key Performance Indicators KPI			*Energy*				*Water*		
Fiscal Year	*Area*	*Students*	*Total Energy*	*Energy Cost*	*Energy/Area*	*Energy/FTE*	*Water*	*Water*	*Water/Area*
	GSF	*Eq. FTE*	*MMBTU*	*$*	*BTU/GSF*	*MMBTU/FTE*	*Gal*	*Gal / GSF*	*Gal / FTE*
2002-03	**4,269,699**	**12,354**	**537,824**	**4,990,987**	**125,963**	**44**	**336,408,512**	**79**	**27,231**
2003-04	4,942,520	12,708	571,384	5,527,654	115,606	45	290,356,396	59	22,848
2004-05	4,987,544	13,099	594,916	6,248,603	119,280	45	543,824,424	109	41,516
2005-06	5,177,689	13,723	620,424	7,622,474	119,827	45	175,592,520	34	12,795
2006-07	5,415,496	14,219	602,349	6,884,414	111,227	42	154,828,520	29	10,889
2007-08	5,415,496	14,704	597,302	7,593,983	110,295	41	155,922,844	29	10,604
2008-09	5,415,496	15,097	577,867	6,861,603	106,706	38	171,504,432	32	11,360
2009-10	5,415,496	15,670	585,475	6,530,241	108,111	37	183,458,968	34	11,708
2010-11	5,551,245	16,036	615,587	6,753,156	110,892	38	141,496,916	25	8,824
2011-12	5,510,548	15,841	582,985	6,663,983	105,794	37	122,794,672	22	7,752
2012-13	5,716,735	15,683	605,897	6,853,774	105,987	39	130,566,923	23	8,325
2013-14	5,999,437	15,009	629,295	7,234,731	104,892	42	123,906,620	21	8,256
2014-15	6,086,061	14,915	635,534	6,959,803	104,424	43	126,757,984	21	8,499
2015-16	6,163,784	17,365	642,376	6,783,434	104,218	37	133,052,004	22	7,662
2016-17	6,408,406	17,891	668,955	7,435,123	104,387	37	143,057,700	22	7,996
2017-18	6,531,155	18,153	674,606	7,521,794	103,290	37	132,712,640	20	7,311
2018-19	6,542,163	18,303	672,766	7,435,361	102,835	37	131,447,729	20	7,182
2019-20	6,586,747	18,249	634,193	6,554,646	96,283	35	130,134,944	20	7,131
2020-21	**6,737,988**	**17,811**	**673,406**	**6,536,559**	**99,942**	**38**	**115,987,304**	**17**	**6,512**
% Change FY2021 to 2020	2%	-2%	6%	-0.3%	4%	9%	-11%	-13%	-9%
% Change FY2020 to 2003	54%	48%	18%	31%	-24%	-20%	-61%	-75%	-74%
% Change FY2021 to 2003	58%	44%	25%	31%	-21%	-13%	-66%	-78%	-76%

Decreased EUI (BTU per GSF) by 21% compared to baseline year FY2003.




Energy Use Intensity EUI (BTU/GSF) & Students (FTE)
Since 2003 Baseline
Baseline EUI
125,963
FTE
12,354
2020 FTE
18,249
2021 FTE
17,811
2021 EUI
99,942
2020 EUI
96,283
2019 EUI
102,835
Energy Use Intensity EUI
Students FTE
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
EUI (BTU/GSF)
Students FTE


Total Energy (MMBTU) & Area (GSF)
Since 2003 Baseline
2021 GSF
6,737,988
2021 MMBTU
673,406
2003 GSF
4,269,699
2003 MMBTU
537,824
from 2003 Baseline
25%
MMBTU Increase
58%
GSF Increase
Energy MMBTU
GSF
700,000
680,000
660,000
640,000
620,000
600,000
580,000
560,000
540,000
520,000
500,000
7,000,000
6,500,000
6,000,000
5,500,000
5,000,000
4,500,000
4,000,000
3,500,000
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
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2010-11
2011-12
2012-13
2013-14
2014-15
2015-16
2016-17
2017-18
2018-19
2019-20
2020-21
Energy MMBTU
GSF

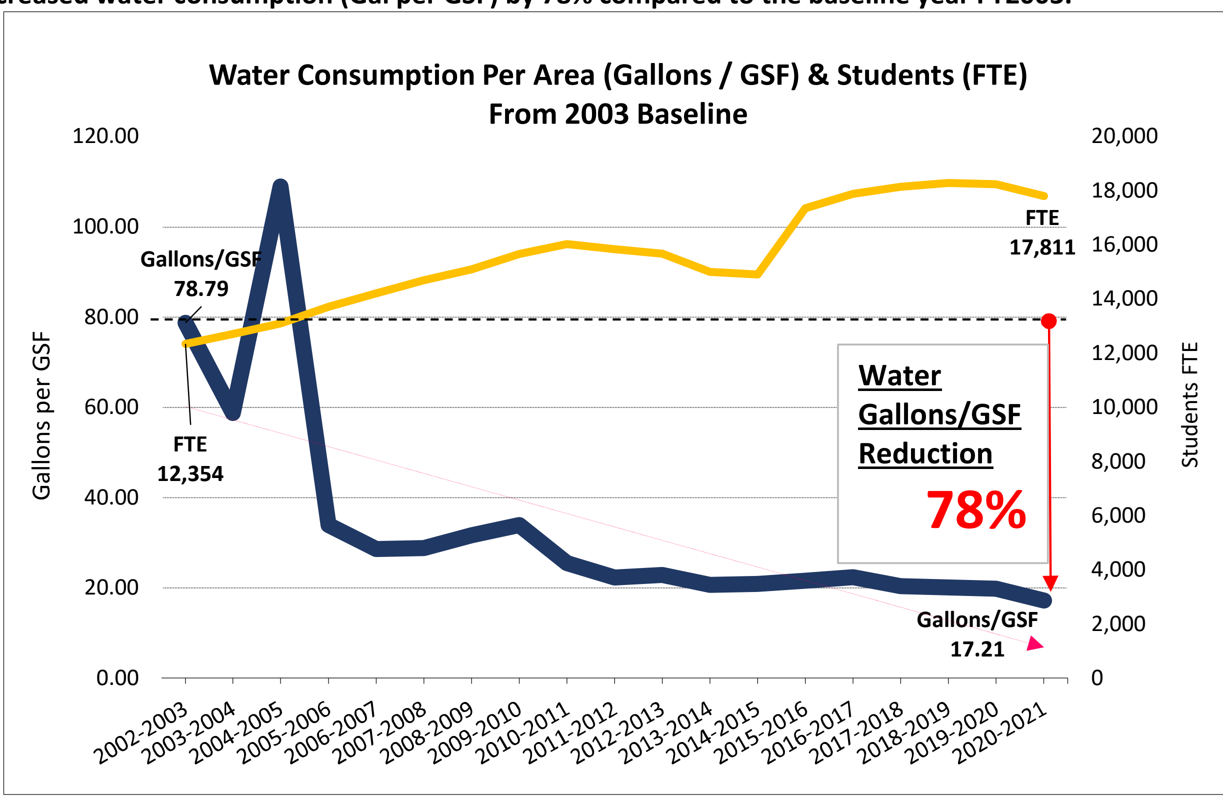
IV. BASELINE UTILITIES OVERVIEW

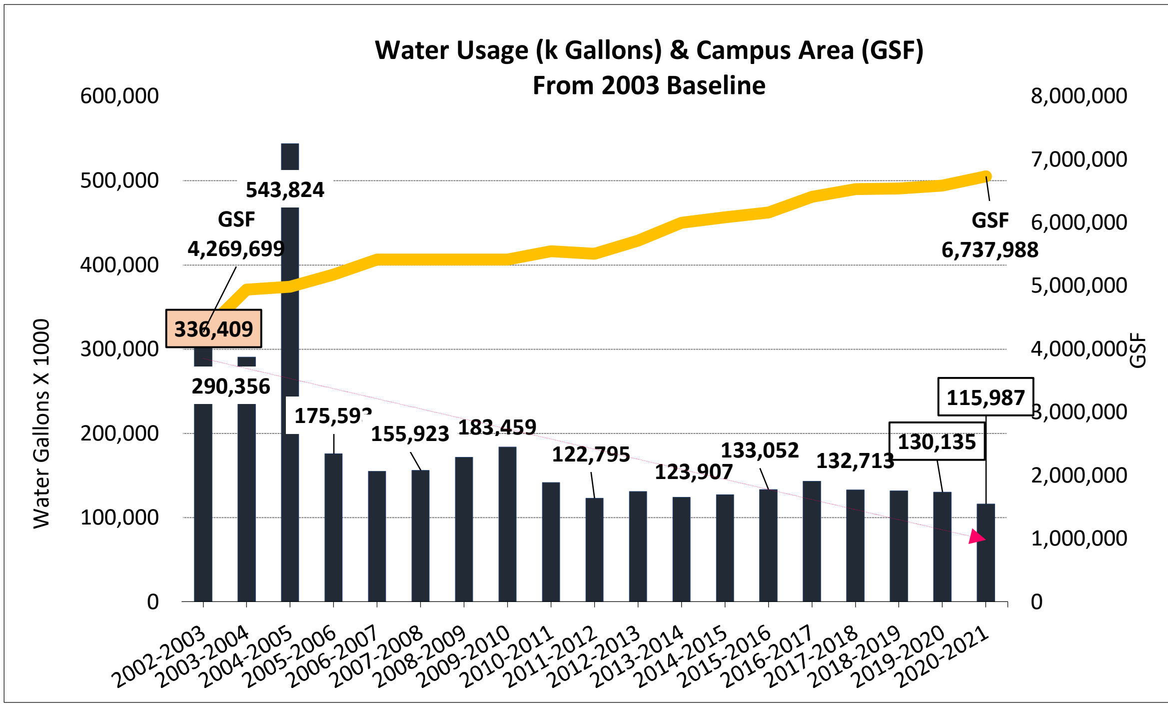
- WATER

UNCG receives water and sewer service from the City of Greensboro. The University owns and maintains a distribution system that receives water through three (3) City master meters and distributes it to over 60 buildings. UNCG also has water service for several outlying properties as well. Most buildings on campus have UNCG-owned water meters that are read, and data is subsequently entered into a database. Where water is used for irrigation or cooling towers, submeters have been installed so that the University can take monthly meter readings of water that does not enter the sanitary sewer system in order to receive appropriate credits from the City of Greensboro.

UNC Greensboro has made tremendous progress in reducing water consumption. UNCG's Facilities organization places special emphasis on leak investigation and underground steam repairs, as well as on identifying and eliminating any wasteful operational practices. Installation of water-conserving fixtures during new construction and renovations has also been implemented. These practices have led to a 78% reduction in water consumption (per GSF) since the baseline year, FY2003 and 13% reduction when compared over last fiscal year.

Decreased water consumption (Gal per GSF) by 78% compared to the baseline year FY2003.

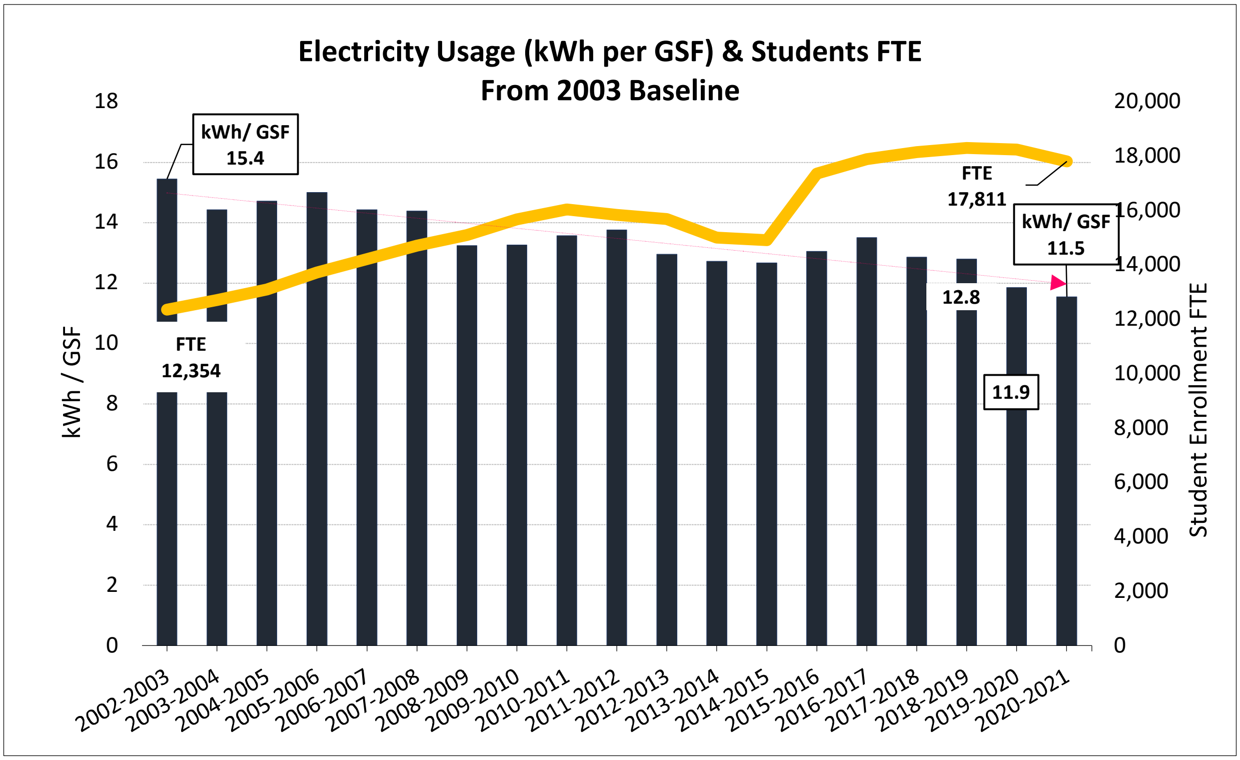




- ENERGY (Electricity, Natural Gas, and #2 Fuel Oil)

Electricity: Duke Energy provides electric power to UNCG facilities through over a hundred accounts. By far the largest account is the main campus substation that feeds an underground medium voltage electrical distribution system connected to more than 60 buildings. The campus substation is on a time-of-use electricity rate schedule that is reviewed annually to evaluate the best rate options and the incentive programs for which UNCG qualifies. In addition to reviewing the main substation account, all other UNCG accounts with Duke Energy are evaluated for best rate options on an annual basis. All buildings served by the substation have electricity submeters that are read monthly and the values are entered into a database. UNCG has taken steps toward automating the UNCG-owned meter reading process by giving the UNCG meter readers a comprehensive electronic form using an iPad with Google Sheet. The new approach is more efficient because it replaces using the cumbersome Logbook where the meter readers had to write down each meter reading which was subsequently manually entered by others into a spreadsheet.

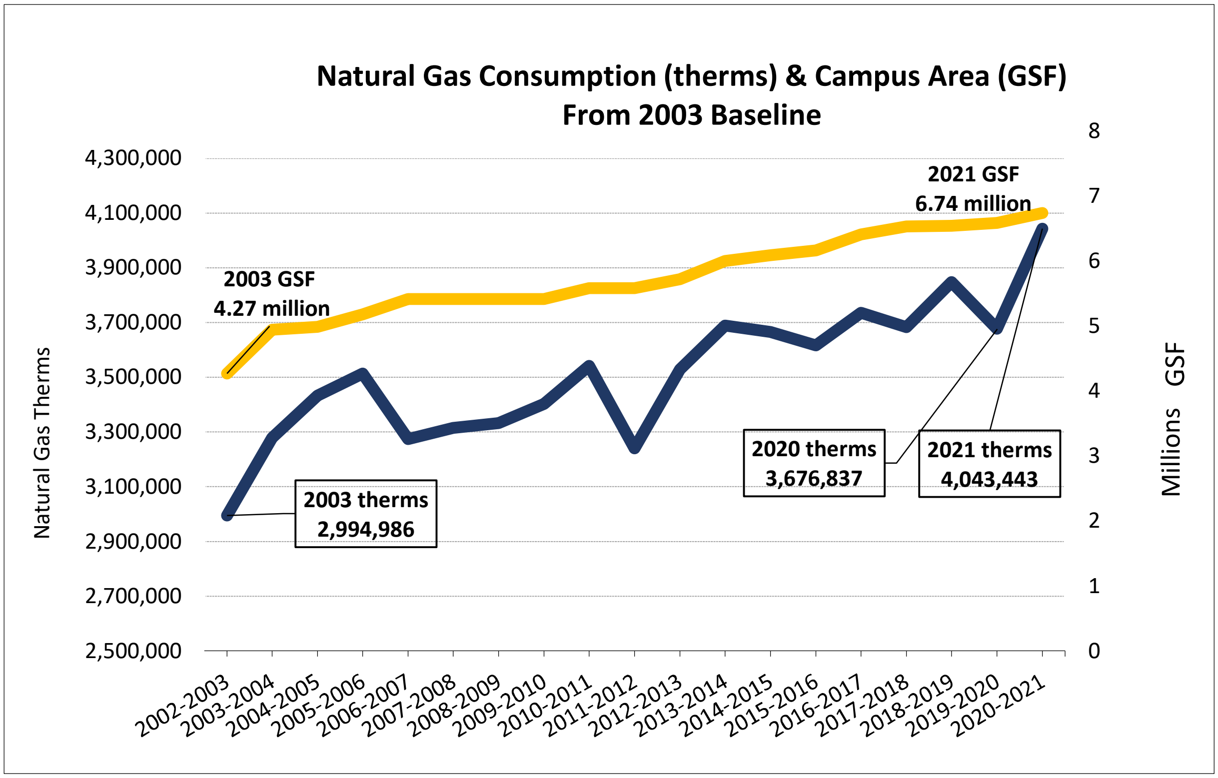
In FY2021, UNCG campus total electricity bill $4.66 million for 77.77 million kWhs, which represents 11.5 kWh per GSF, and 4,367 kWhs per FTE student**.** FY2021 showed a 25% reduction in kWhs per GSF compared to the baseline year (15.4 kWh/GSF), and a 2.6% reduction versus the prior year.



Natural Gas: Steam Plant's Natural Gas is purchased through State Term Contract 405N, which is currently held by Texican Natural Gas Company, LLC. Piedmont Natural Gas (PNG) provides service to the campus and outlying properties. Complying with the N.C. Gen. Stat. § 105-164.13(52) which provides tax exemption to State agency accounts, all University natural gas accounts are tax free.

In FY2021, the total natural gas expenditures were $1.83 million for 4.04 million therms, that reveals a 35% increase over the baseline year in actual therms, and a 10% increase in over 300,000 additional therms compared to FY2020. Natural gas consumption per GSF 60,000 BTU/GSF shows 8% increase over last year and 14% reduction when compared to FY2003 (70,145 BTU/GSF). Natural gas energy per students is 22.7 MMBTU/FTE, shows 13% increase compared to FY2020 and 6% reduction versus the baseline year.

No. 2 Fuel Oil: UNCG Steam Plant is capable of using No. 2 fuel oil as a backup fuel to natural gas. This provides the University with an emergency fuel source and allows Piedmont Natural Gas (PNG) to interrupt natural gas service to the campus during times of peak gas demand. The ability to have gas service interrupted allows the University to purchase gas at a lower rate. In FY2021, UNCG used over 26,000 gallons of No. 2 fuel oil at the Steam Plant for few days curtailment period in wintertime when PNG interrupt gas service to UNCG.



- STEAM AND CHILLED WATER

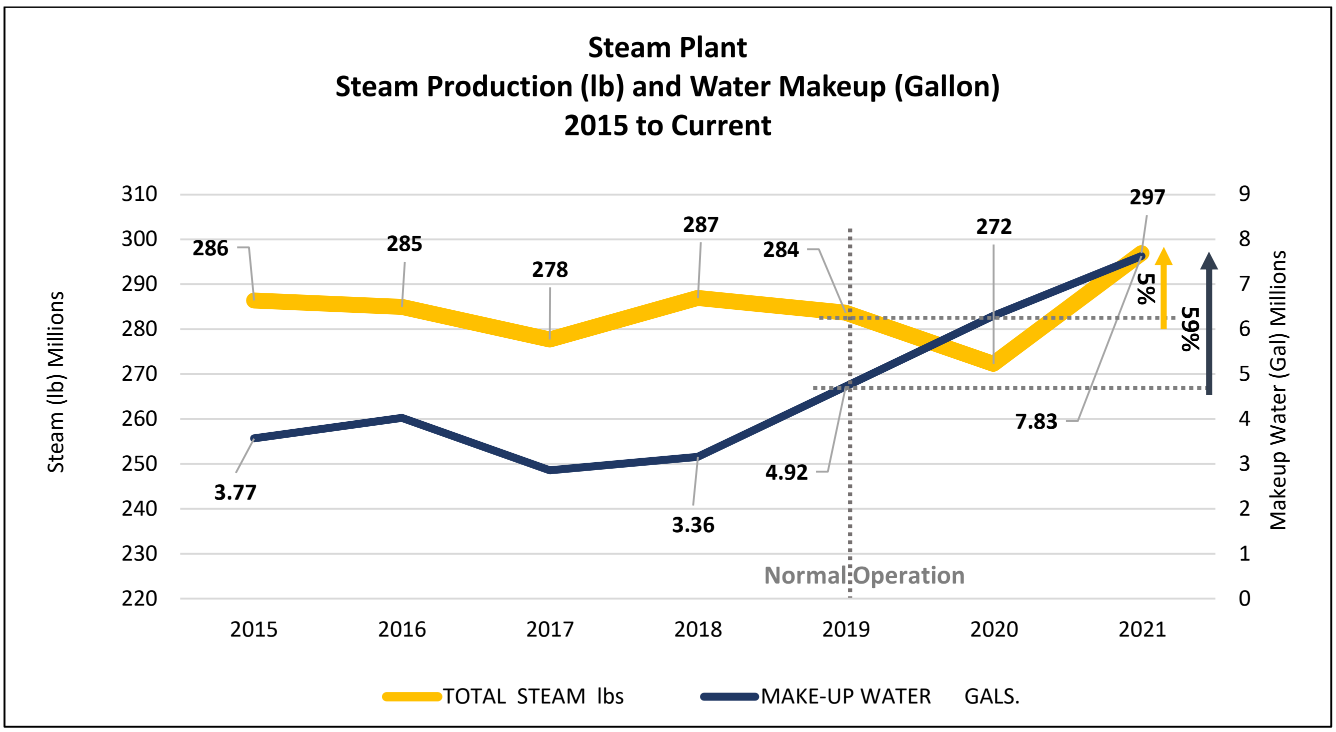
The University uses purchased power and natural gas to create chilled water and steam that are distributed to the campus. Most buildings connected to the Steam Plant and Chiller Plants do not have a steam meter or chilled water meter; however, the University has developed a comprehensive Campus Metering Plan to install steam meters and chilled water meters in all buildings. So far, USCF funds have been used to install 7 steam meters in State appropriated funded accounts. Facilities Operations uses an assigned buildings gross square footage to allocate the total steam and chilled water cost for each entity.

Steam: Steam goes to 63 buildings on the main campus. The UNCG Steam Plant has four boilers with 190,000 pounds per hour (PPH) total capacity. Steam distribution capacity covers the campus steam peak load even when included the new constructed Nursing and Instructional Building NIB.
In FY2020, Steam Plant Controls was completed replacing the outdated boiler controls, burner management system, and master controller. In FY2021, one of proposed USCF projects is replacing with new Boiler #1 feedwater pump and perform VFD upgrade that was eliminated from prior year control upgrade project due to limited funding.

Much of the campus steam infrastructure and piping system is 50 years old. The system has been periodically serviced in response to failures or normal wear and tear, and sections need a full replacement. UNCG has replaced three different sections over the years as funds were available. In Summer 2019 Phase-4 project was planned to replace steam and condensate pipes, manhole refurbishment and all associated sitework from manholes #73 to #74 (EUC to Bryan Building Service Drive at Theta Street). Part-A of the project was completed between the Elliott University Center and Sterling St. Funding was not available to complete Part-B upgrading the system between Sterling St. and the Bryan Building. In Summer 2020, couple of condensate leaks were identified and subsequently fixed during 2021. After a large 5.1 magnitude earthquake hit North Carolina in August 2020, those leaks got worse affected by ground movement. There were five leaks identified, the first four of them were serviced to be controlled, the fifth one is awaiting funds and proposed for FY2021-2022 Utility Savings Carry Forward funds. Those leaks are located in Steam Plant-backside, 2-leaks in Theta Street (Phase-4/Part-B stopped for not enough funding), manhole MH55 Steam Tunnel, and MH 85 by the EUC. The last in Manhole 11 to 12 College Ave which is planned to be fixed as soon USCF funds allocated.

In the current Campus Master Plan updated by Affiliated Engineers and Sasaki, UNCG has included five (5) high-priority steam projects of $3.9 million estimated cost to replace and renew critical portions of the steam distribution system.

UNCG Steam Plant, including the new constructed NIB building, serves over 2.2 million assigned GSF (~60% of total building GSF). In FY 2021 the Plant produced 296.96 million pounds of steam a 9% increase than prior year steam production which justifies new NIB building load and 256 additional Heating Degree Days HDDs than the prior year. FY20201 steam makeup water was 7.83 million gallons of water recording 21% increase 1.33 million additional gallons of water used to make up the condensate leaks showing 59% increase than FY2019 a typical year operation. Energy and water cost of steam production can furtherly controlled if UNCG has the funds to move forward with replacing the critical portions of the steam and condensate distribution system.



Chilled Water: The McIver Chiller Plant (4 chillers with 6,000-ton total capacity) and new South Chiller Plant (two chillers with 3,00-ton) produces chilled water to serve HVAC needs in 43 buildings including the new constructed NIB facility.

The updated Campus Master Plan by AEI and Sasaki shows summer 2020 demand was approximately 6,200 tons when including partial load at Nursing and Instructional Building for construction phase cooling and the addition of Ragsdale-Mendenhall Residence Hall on the chilled water system.

In FY2021 UNCG accepted the new constructed South Chiller Plant (2 chillers 3,000-ton current capacity) been designed for five chillers with 7,500-ton ultimate capacity. However, on August 7, 2020 the new South Chiller Plant SCP began operating to continuously to support campus chilled water loop with 3,000-ton baseload capacity. The new SCP construction and commissioning was finally completed to have the plant more efficiently serves at least half of campus cooling load along with existing McIver Chiller Plant. The two chiller plants both serve over 1.5 million assigned GSF including NIB and Ragsdale Mendenhall Residence Hall that connected recently to campus chilled water loop in 2019.

- ENERGY DATA MANAGEMENT & BAS

UNCG collects energy consumption and billing information on a monthly basis for all buildings or facilities not served directly by utility companies. Currently, meters are still read manually, and the data analyzed via MS Excel. These data are used to discover trends in energy consumption and identify facilities that warrant more detailed evaluations. UNCG Facilities Operations staff also examine the monthly data to find and correct billing errors and to identify any anomalies in the energy and water consumption of specific facilities.

Currently, UNCG has 65 buildings on the Tridium Building Automation System (BAS). In FY2018-19, UNCG finished moving all buildings from the older Signal building automation system to Tridium Niagara AX JACEs including the Housing and Residence Life buildings. In FY2021, when Tridium alert stop supporting Niagara AX Supervisor licenses, UNCG contracted with Schneider Electric to migrate Niagara AX Server to Niagara 4 licensing model to maintain Tridium BAS on campus.

V. SUSTAINABILITY & ENERGY

The UNCG Green Fund has awarded approximately $346,000 to 59 projects during its first six years of existence to support sustainability initiatives on campus. Through FY21, 13 utility savings and resource conservation projects received funding and have been implemented leading to annual savings of 314,352 kWh of electricity, 1 million gallons of water, and $36,431, with an average project return on investment of 7 years.

In FY21, the Green Fund Committee awarded over $74,000 to support a total of 9 projects in different areas. A total of $66,179.47 was awarded to the following Facilities related projects:

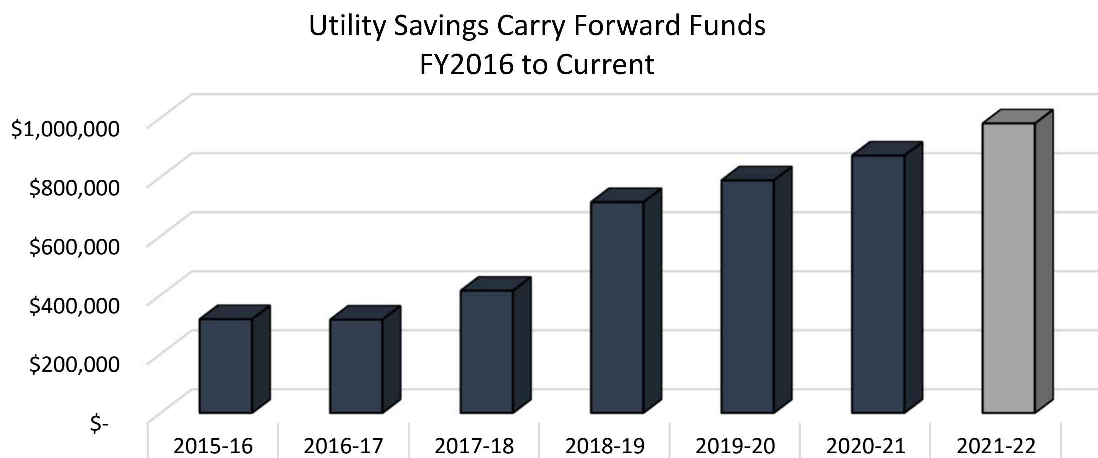
- $24,745.00 to convert approximately sixty-seven exterior lighting fixtures to LEDs.
- $27,000.00 to upgrade old stage lighting to LEDs.
- $1,386.97 to purchase a hot water heater for the Coordinator of Residence Life's apartment in Jefferson Suites.
- $3,327.50 to purchase 550 LED bulbs to upgrade the emergency lighting in Reynolds, Grogan, and Cone residence halls.
- $9,720.00 to pay for student labor to continue the development of a new UNCG Energy Dashboard.

VI. PROJECTS AND ENERGY SAVINGS

To achieve energy consumption and utilities cost reduction goals, UNC Greensboro focuses first on low- and no-cost energy conservation measures (ECMs). The HB 1292 Utility Savings Carry Forward (USCF) program is used as a main resource to support energy saving projects.

UNCG started reporting/requesting the USCF credits in FY2011. The USCF funds in 2012 was around $232,000 with no ESCO savings ($7.2 million PC in 2008) since the guaranteed energy savings contract pre-dated the HB 1292 legislation. FY2016 approved/executed funds were $ 308,068, which increased to $872,169 in FY2021, and to $981,009 carried forward to FY2022. UNC Greensboro plans ahead to get the best of the program and spend the entire USCF amount before it disappears by the end of the fiscal year. In fiscal year 2021, the entire approved/funded was spent down to the last penny.

Utility Savings Carry Forward funds (HB1292 / General Statute 143-64.12(a)) will continue to be invested in energy conservation measures to achieve the University and State energy reduction goals. In addition, the fund will back up the Repair and Renovation R&R funds in replacing failed and outdated HVAC equipment with more energy efficient equipment in State-supported facilities. The funds will also support other critical projects on campus such as repairing steam/condensate leaks in the steam distribution system.



	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
USCF Fund	$318,068	$316,585	$414,587	$714,806	$788,574	$872,169	$981,009

FY2021 projects included the following:

Utility Savings Carry Forward Projects - FY21			
		Expenses	
117537-1	Replace Chiller Module #2 - Bryan	$ 85,000	HVAC Shop Supervisor
117537-2	Rooftop Unit Replacement - University Graphics & Printing	$ 18,626	HVAC Shop Supervisor
117537-3	Replace Split System A/C - Campus Supply Store	$ 21,820	HVAC Shop Supervisor
117537-4	Campus-Wide Steam Distribution	$ 342,942	Utilities Manager
117537-5	Replace Cooling Tower - Bryan	$ 45,951	HVAC Shop Supervisor
117537-6	Rooftop Units Replacement - Becher Weaver	$ 104,967	HVAC Shop Supervisor
117537-7	VAV Controls Upgrade - 2nd Floor Sink Building	$ 47,310	HVAC Shop Supervisor
117537-8	LED Upgrade - Studio Arts Building	$ 140,213	Electric Shop Supervisor
117537-9	Miscellaneous HVAC Equipment Replacement	$ 28,754	HVAC Shop Supervisor
117537-10	Steam Plant Controls Enhancements	$ 17,650	Steam Plant Supervisor
117537-11	Replace North Fields Well Pump	$ 18,935	Grounds Supervisor
		$ 872,169	

FY2022 carry forward $981,009 approved amount planned to support the following under considerations projects:

1- $25,000 for Steam Plant Boiler #1 Feedwater Pump. Replace the existing 70 HP horizontal feedwater pump with new 30 HP vertical pump and motor with VFD. Estimated to save 396 MMBTU in electricity usage.
2- $175,000 for Steam Plant Economizer #4. Replace the current 2004 economizer that has leak issues with new one. Estimated to save 3,975 MMBTU in therms usage.
3- $175,000 for McNutt Building data center replace machine room DX System (Data Aire) with new more efficient one. Estimated to save 692 MMBTU in electricity usage.
4- $75,000 for multiple buildings to replace faulty return/outdoor dampers, actuators, and linkages to improve equipment efficiency.
5- $60,000 for Cone Art Building replace and relocate temperature and humidity sensors to enhance HVAC system performance in the Weatherspoon Art Museum. Estimated to save 281 MMBTU in electricity and therms usage.
6- $276,000 Steam System Piping Repair MH #11 to MH #12 south end of College Avenue. The work was planned to inspect, repair, and re-insulate leaking steam/condensate piping.
7- $15,000 for Moore Humanities and Administration Building and Graham Building to provide mini splits for ITS rooms to reduce building cooling load.
8- $75,000 for Curry Building and School of Education buildings LED upgrade. Estimated to save 611 MMBTU in electricity usage.
9- $105,000 for Becher-Weaver Building to replace an outdated 1965 boiler with new more efficient one with BAS system control.

VII. GOALS

UNC Greensboro is expanding in students and staff head counts, in addition to the increase in campus indoor footprint. Since the baseline year, FY2003, the campus GSF has increased by 58%. However, during that same time period, UNCG has decreased its Energy Use Intensity by 21%. As of FY 2021, the University has achieved a 78% reduction in water gallons/GSF surpassing the State water reduction mandate.

UNCG supports the State greenhouse gas emissions goal of 40% reduction below 2005 levels. An official 2018 UNCG greenhouse gas emission report showed a reduction of 8% from 2009 levels (as far back as the inventory goes). Achieving a decrease of 24% MTeCO2 per 1000 gross square feet and a decrease of 18% MTeCO2 per weighted campus user. UNCG is currently working on a new GHG inventory to document performance in this regard.

Despite budgetary constraints, and not reaching the 2015 energy reduction mandate, UNCG will continue embracing Executive Order 80 and UNC System energy goals. Utility Savings Carry Forward funds (HB1292 / General Statute 143-64.12(a)) will continue to be invested in energy conservation measures throughout State-supported campus facilities. Efforts to reduce UNCG's per square foot energy consumption will continue, guided by the UNCG Climate Action Plan and the responsible stewardship approach of the Facilities Operations Energy Management Team.

UNIVERSITY of NORTH CAROLINA
PEMBROKE

STRATEGIC ENERGY / WATER PLAN

2020 / 2021

UNIVERSITY *of* NORTH CAROLINA
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EXECUTIVE SUMMARY

UNC Pembroke continues to develop and maintain its efforts towards conservation of energy and water resources within all campus facilities. We are creating, implementing and following an effective Strategic Energy/Water Conservation Plan. The objective of the Strategic Energy/Water Conservation Plan is to foster economically and environmentally responsible usage of valuable resources in accordance with state legislation, while providing a positive and comfortable learning environment for students, faculty, staff and visitors.

Key Elements of the plan include:

• Educate and engage faculty, staff and students in energy and water conservation through presentations, emails, handouts, web pages and other effective forms of communication that help in understanding that effective energy conservation supports the primary mission of the university.

• Maintain Sustainability Committee facilitated through Staff Counsel to get faculty, staff and student organizations more involved with conservation as part of a larger scope of campus environmental stewardship efforts.

• Continue accurate measurements and analysis of electricity, fossil-based fuels and water usage. Quarterly reviews of consumption, trends and costs will be posted and advertised for the campus community to review.

• Continue to conduct annual reviews of utility billing rates with each supplier and continue monthly audits of each utility invoice by our energy management efforts.

• Implement up to date training for Facility Operations staff in order to perform planned service and upgrades that improve the performance of all facility equipment and university owned vehicles to reduce energy waste.

• Continue to benchmark and develop KPI's (key performance indicators) that clearly measure real energy and water conservation progress while factoring for facility and student growth.

UNIVERSITY of NORTH CAROLINA
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NORTH CAROLINA LEGISLATIVE BASIS FOR PLAN

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2007 / SENATE BILL 668

RATIFIED BILL

AN ACT TO PROMOTE THE CONSERVATION OF ENERGY AND WATER

SECTION 3.1.(a) G.S. **143-64.12. Authority and duties of State agencies. The Department; State agencies and State institutions of higher learning.**

(a) The Department of Administration through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan annually and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office an annual written report of utility consumption and costs.

North Carolina
Executive Order 80

In Executive Order 80: North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy, Governor Roy Cooper laid out a series of goals for the state to strive to accomplish by 2025:

- Reduce statewide greenhouse gas emissions to 40% below 2005 levels
- Increase the number of registered, zero-emission vehicles (ZEVs) to at least 80,000
- Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels

UNIVERSITY of NORTH CAROLINA
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EXECUTIVE SUPPORT FOR ENERGY CULTURE CHANGE

a) Maintain work with key members of Senior Administration Staff to develop and publicize Strategic Energy & Water Management Policies that define:

   i. The universities commitment to a fiscally and environmentally responsible Energy and Water Management Plan.

   ii. Measurable and achievable goals and objectives with reasonable timelines.

   iii. Accountability and resources for plan implementation

   iv. Continuous improvement efforts after initial implementation.

b) Expand our comprehensive Strategic Energy and Water Management Plan to guide:

   i. Efforts for initial implementation of the baseline measurement & identification of energy and water conservation opportunities, concept development of projects and process changes and prioritization of improvement efforts.

   ii. Provide funding and staff resources to define, develop, and execute approved energy and water related capital projects, expense projects and process improvements.

   iii. Schedule reviews of conservation and efforts and regular updates to the plan.

c) Continue to educate faculty, staff and students through scheduled presentations, emails, handouts, subcommittees and other effective forms of communication about the Energy and Water Management Policies and the Strategic Energy and Water Management Plan. This will provide guidance into conservation measures and techniques they can implement in our daily campus environment and also within home activities.

d) Include Strategic Energy and Water Management Plan presentations in appropriate campus and department meetings.

e) Create a Strategic Energy and Water Management Plan "Professional Development" presentation for faculty and staff.

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BASELINE COST & ENERGY (KPI) FY 20/21

a. Financial Evaluation

Detailed cost and percentage of total expenditures

Fiscal Year	Electricity	Natural Gas	Water / Sewer	LP Gas	Heat Oil #2	Total Utility Expenditures	Consumption BTU / Ratio :
02/03	$1,031,658	$487,910	$657,512	-	$25,179	$2,202,259	115,427,334,610
03/04	$1,036,199	$441,680	$739,701	-	$22,890	$2,240,470	110,599,887,476
04/05	$1,068,894	$399,653	$821,890	-	$28,500	$2,318,937	108,632,852,564
05/06	$1,071,394	$443,081	$897,456	-	$9,622	$2,421,553	113,122,320,944
06/07	$1,481,650	$375,742	$983,536	-	$20,115	$2,861,043	114,495,523,300
07/08	$1,756,487	$532,958	$1,124,397	-	$43,072	$3,456,914	131,302,377,880
08/09	$1,783,521	$485,908	$954,511	-	$29,311	$3,253,251	135,506,884,220
09/10	$1,843,824	$343,171	$1,031,474	-	$35,584	$3,254,053	129,838,596,400
10/11	$1,836,240	$334,134	$1,012,310	-	$34,030	$3,216,714	132,046,538,137
11/12	$1,744,547	$284,852	$944,904	-	$12,217	$2,986,520	126,574,203,570
12/13	$1,627,136	$285,569	$910,777	-	$9,925	$2,833,407	119,326,071,600
13/14	$1,618,507	$309,944	$847,432	-	$7,789	$2,783,672	115,845,626,170
14/15	$1,578,102	$260,252	$833,050	-	$10,275	$2,627,679	107,514,433,190
15/16	$1,577,367	$177,822	$820,197	-	$2,998	$2,578,384	106,187,889,200
16/17	$1,518,906	$219,918	$853,716	-	$1,000	$2,594,364	100,908,539,600
17/18	$2,280,439	$200,938	$1,063,134	-	$2,998	$3,343,573	125,172,979,512
18/19	$1,917,421	$272,133	$892,676	-	$2,411	$2,810,097	157,573,923,320
19/20	$1,592,255	$192,924	$810,429	-	$5,000	$2,600,608	143,997,508,240
20/21	$1,920,363	$210,084	$890,128	-	$0.00	$3,069,183	155,914,389,536

b. Utility Cost per sq. /ft.

Fiscal Year	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Electrical	$1.17	$1.18	$1.21	$1.12	$1.41	$1.58	$1.60	$1.65	$1.65	$1.39	$1.21	$1.20	$1.17	$1.17	$1.13	$1.18	$0.95	$0.92	1.06
Nat. Gas	$0.55	$0.50	$0.45	$0.46	$0.36	$0.48	$0.44	$0.31	$0.30	$0.23	$0.21	$0.23	$0.15	$0.13	$0.16	$0.11	$0.15	$0.11	0.11
Water/Sewage	$0.75	$0.84	$0.93	$0.94	$0.94	$1.01	$0.86	$0.93	$0.91	$0.75	$0.68	$0.63	$0.62	$0.61	$0.63	$0.61	$0.51	$0.46	0.49
Total Utility	$2.47	$2.52	$2.59	$2.52	$2.71	$3.07	$2.90	$2.89	$2.86	$2.37	$2.10	$2.06	$1.94	$1.91	$1.92	$1.90	$1.61	$1.49	1.66

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c. Utility Cost per Student.

02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
$466	$446	$412	$416	$482	$548	$522	$488	$464	$478	$452	$444	$420	$400	$414	$468	$338	$315	$372

d. Enrollment

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
4,722	5,027	5,632	5,827	5,937	6,303	6,235	6,664	6,940	6,251	6,269	6,222	6,269	6,441	6,268	7,137	7,698	8,262

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FISCAL YEARS ENERGY EVALUATIONS VIA SEO ANNUAL REPORT

Year	ENERGY EVALUATION					
	Energy $ Avoided	Energy $/Gsf	$/Mmbtu	$/Mmbtu %Change	Btu/Sf	Btu/Sf % Change
2002-03		$1.76	$13.38		131,194	
2003-04	$65,505	$1.71	$13.57	1%	125,707	-4%
2004-05	$93,633	$1.70	$13.78	3%	123,471	-6%
2005-06	$170,519	$1.59	$13.47	1%	117,993	-10%
2006-07	$378,379	$1.79	$16.40	23%	109,189	-17%
2007-08	$266,327	$2.09	$17.76	33%	117,749	-10%
2008-09	$183,001	$2.06	$16.96	27%	121,520	-7%
2009-10	$281,692	$1.99	$17.12	28%	116,437	-11%
2010-11	$237,857	$1.98	$16.69	25%	118,417	-10%
2011-12	$618,574	$1.62	$16.13	21%	100,687	-23%
2012-13	$919,851	$1.43	$16.11	20%	88,738	-32%
2013-14	$1,012,366	$1.44	$16.71	25%	86,150	-34%
2014-15	$1,150,098	$1.33	$16.69	25%	79,955	-39%
2015-16	$1,162,784	$1.31	$16.56	24%	78,968	-40%
2016-17	$1,302,480	$1.29	$17.25	29%	75,042	-43%
2017-18	$1,850,044	$1.32	$18.22	36%	72,432	-45%
2018-19	$841,417	$1.11	$12.17	-9%	91,181	-30%
2019-20	$1,028,428	$1.04	$12.43	-7%	83,325	-36%
2020-21	$1,115,364	$1.21	$13.98	4%	86,777	-34%

UNIVERSITY of NORTH CAROLINA
PEMBROKE

b. Fiscal Years Water/Sewer Evaluations via SEO Annual Report

	WATER/SEWER EVALUATION				
Year	**Water $ Avoided**	**$/Kgal**	**$/Kgal %Change**	**Gal/Sf**	**Gal/Sf %Change**
2002-03		$21.21		35.24	
2003-04	-$82,184	$21.21	0%	39.64	12%
2004-05	-$164,370	$21.21	0%	44.05	25%
2005-06	-$180,955	$21.21	0%	44.14	25%
2006-07	-$199,872	$21.21	0%	44.22	26%
2007-08	-$231,956	$22.71	7%	44.40	26%
2008-09	-$18,032	$23.83	12%	35.92	2%
2009-10	$3,621	$26.34	24%	35.11	0%
2010-11	$17,146	$26.20	24%	34.65	-2%
2011-12	$305,186	$28.22	33%	26.63	-24%
2012-13	$402,599	$27.72	31%	24.44	-31%
2013-14	$494,013	$28.31	33%	22.26	-37%
2014-15	$508,395	$28.31	33%	21.88	-38%
2015-16	$521,248	$28.31	33%	21.54	-39%
2016-17	$487,727	$28.31	33%	22.43	-36%
2017-18	$388.954	$23.85	12%	25.80	-27%
2018-19	$790,721	$27.64	30%	18.69	-47%
2019-20	$959,106	$29.06	37%	16.14	-54%
2020-21	$795,714	$26.63	26%	18.61	-47%

UNIVERSITY of NORTH CAROLINA
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SUPPLY SIDE: ACTION PLANS

Because utility consumption is impacted and consumed in some manner by each and every one interacting with the campus facilities we will continue to expand and implement the following actions:

a) Our UNCP Sustainability Council includes and involves all divisions of the campus community. Their primary purpose will be to invite and involve the entire campus community to participate in helpful and constructive sustainability/conservation practices for the upcoming semester.

b) Our Energy Utility/Sustainability Program Coordinator Position is currently vacant, but in the process of being filled. This position is responsible for the implementation of utility efficiency strategies in new and existing campus buildings. This position supports the appropriate campus offices that impact all campus sustainability issues and provides utility consumption & cost reporting to the campus and appropriate outside agencies.

c) Three solar car charging stations have been installed along with a non-solar unit on our campus.

d) Other solar projects are currently being evaluated and will be discussed in the coming year. Moving our campus forward with additional solar projects is a top priority for UNCP.

e) A Hydrology Study commenced in partnership with the Town of Pembroke, Robeson County and UNCP to address storm water drainage, frequent flooding and watershed analysis.

f) We have partnered with several academic entities across campus to provide Sustainability internships.

UNIVERSITY of NORTH CAROLINA
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DEMAND SIDE: EFFICIENCY MEASURES IN PROGRESS & COMPLETED

a) Vending machines throughout campus were upgraded to Energy Star machines.

b) Digital Smart Meters were brought online in primary facilities to comply with Measure and Verification goals.

c) UNCP installed a 250 ton high-efficiency chiller in the Oxendine Science Building, which replaced an inefficient outdated one.

d) UNCP installed one high-efficiency condensing boiler in the Sampson Classroom building.

e) Phase one of the LED Lighting upgrade in the Mary Livermore Library has been completed. Phase II will begin in fall 2021.

Energy Awareness Campaign & Strategy

a) Over 34% percent of energy consumption was avoided with the assistance of employee and student awareness and conservation choices.

b) UNCP continues to calculate the quarterly impact, based on campus wide consumption and cost.

c) Incentive programs have been maintained between student groups to reduce the baseline in Btu per sq. ft. and reward the group with the lowest consumption results.

d) Updated the UNCP Energy / Water Conservation Policy and advertised it via our Facilities Website.

e) Continued to adhere to ASHRAE standards for COVID-19, building management best practices.

- Merv 15 Filters are campus wide
- Water bottle refill retrofits in high traffic drinking fountains.
- Low flow .5 GHP flush valves, conservation fixtures and hands free units campus wide
- Install occupancy sensors campus wide

The following projects were major parts completed via our Guaranteed Energy Savings Performance Contract dated May 31st 2013. This is a seventeen year project.

Jones Athletic Center
1. Installed DDC System
2. Replaced Natural Gas Boilers
3. Upgraded HVAC AHU Systems
4. Installed HVAC / RTU's on Aux. Gym
5. Retrofitted VAV Systems

Livermore Library
1. Upgraded HVAC AHU/DDC Systems
2. Replaced two DX Systems

Oxendine Science Bldg.
1. Installed DDC System
2. Retrofitted all VAV Systems
3. Retrofitted all Lab Hood System

UNIVERSITY of NORTH CAROLINA
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SIGNATURE PAGE

Strategic Energy & Water Plan

I have read and support this Strategic Energy & Water Plan for my Organization

Mark Vesely, ***Director of Facilities Operations***

Signed: Mark Vesely **Date:** 8/31/2021

Travis Bryant, ***Interim Associate Vice Chancellor / Facilities Management***

Signed: Lloyd Travis Bryant **Date:** 8-31-2021

Virginia Teachey, ***Vice Chancellor for Finance & Administration***

Signed: Virginia Teachey **Date:** 8/31/21

Dr. Robin G. Cummings, ***Chancellor***

Signed: ______________________ **Date:** 8/31/21

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This Strategic Energy & Water Mandate serves as a Memorandum of Agreement to support Strategic Energy & Water Plans for the state Utility Savings Initiative.

______________________ ______________________

Director State Energy Office **Date**

ANNUAL REPORT
STRATEGIC ENERGY & WATER PLAN
of
UNCW

This strategic plan was developed **September 1, 2021 by**
Steve Sharpe, UNCW Energy Manager

Table of Contents

Executive Summary

Purpose
The purpose of this report is to summarize UNCW's utility performance (energy and water) for FY 20-21, and to list objectives and strategies for the next fiscal year. Energy usage is compared to the 2002-2003 FY as a baseline.

NC Legislative and Executive Basis for this Plan
(a.) Session Law 2007-546 / Senate Bill 668 requires that energy consumption per gross square foot be reduced 20% by 2010 and 30% by 2015 based on the 2002-2003 fiscal year as a baseline. Each State of NC institution of higher learning is to update its management plan annually and include strategies for supporting consumption reduction requirements.

(b.) Session Law 2008-203 / Senate Bill 1946 - Energy Efficiency Improvement requires an energy reduction of 30% for major construction projects and 20% for major renovation projects based on 2004 codes. Similarly, indoor potable water use for major construction or renovation projects must be 20% less, and sum of outdoor potable water use and harvested storm water use must be at least 50% less based on 2006 NC Building Code.

(c.) Executive Order No. 80 – North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy – The State of North Carolina will strive to accomplish by 2025 the reduction of energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels.

Existing Conditions
UNCW operates a total of 171 buildings, varying in age and totaling 4.8 million square feet. In addition to the buildings, we also maintain related facilities.

Key Elements and Focus Areas of the Plan
● Data collection including accurate measurement and analysis of electricity, fossil based fuels, and water usage to benchmark and to allow for regular review of costs and performance.
● Annual summary that reviews activity related to Energy Supply, Energy Demand, Communication and Training, and Water consumption.
● Identifying and implementing energy 1292 efficiency projects.
● Identifying and implementing receipt supported energy efficiency projects.

Summary of FY 20-21 Accomplishments
Energy consumption per gross square foot decreased this year. UNCW energy consumption has now been reduced by 51% compared to the FY 2002-2003 baseline, exceeding both the 30% reduction target mandated to occur by June 30, 2015 and the Governor's Executive Order of a 40% reduction by 2025. University EUI has been reduced to 79 MBTU/SF.

Significant accomplishments the past year include:
- Construction of P3 housing project with Variable Refrigerant Flow HVAC system and dedicated heat recovery / outdoor air ventilation system
- Construction of new Film Studies Building.
- Expansion of Pond Irrigation to Graham Hewlett Halls, Wagoner Dining, New Parking Lots,Schwartz / Suites Housing Area
- Comprehensive upgrades to Dobo Laboratory Building
- Creation of "virtual energy plant" in which Wagoner Energy Plant and Dobo Energy Plant feed into the same chilled water distribution system and are controlled by plant optimization software.
- Friday Hall Boiler Replacement
- Replacement of constant volume Trask Coliseum AHU#3 with Variable Volume Unit
- Expand Pond Irrigation from Trask Coliseum to James Hall and across front lawn.
- Expand Pond Irrigation around Wagoner Dining Hall
    - Kenan Hall Upgrade fluorescent tubes to LED
- Metering Initiative

  - Upgraded Meters in Student Rec Center
  - Cx'd Wagoner Dining Meters

Summary of FY 21-22 plans

- Retro-Commission Various Buildings
- Design and construction of new dining facility.
- Minimize the use of space heaters throughout campus
- Metering Initiative
  - Continue identifying and repairing meters
  - Identify buildings deficient in metering
  - Continue tying meters into campus building management system
  - Work with billing to establish process of automating meter reading and billing.
- Building Chilled Water / Heating Hot Water circulation bridge Re-Commissioning
  - Re-Cx of building bridges as part of improving central plant efficiencies.
- Investigation of demo sized PV project and/or lease contract for larger systems
- Establish utility corridors to match updated campus master plan
- Bear Hall Boiler Replacement
- Upgrade Lighting CMS Ops, Oyster Hatchery, and Parking Area
- Upgrade CHW, HHW, and DHW Systems at Sports Medicine Building
- Expansion of Irrigation to front of campus, Library Commons, Kenan, DeLoach, Cultural Arts, New Housing Area, Green Track, and Soccer Area
- Stakeholder Member of "Planning an Affordable, Resilient and Sustainable Grid" project awarded to the SEO by DOE run by the NC Cleantech Center and UNC-C EPIC. The project is examining storm related impacts, using the New Hanover County / Wilmington area as a case study, and will model the costs and benefits of investments in making the utility grid more resilient. Some of the ideas include storm hardening infrastructure, distribution control upgrades, distributed generation, energy storage, and localized microgrids.
- Construction of Coastal Engineering Building with Variable Refrigerant Flow HVAC system and dedicated outdoor air ventilation system.
- Investigation of UV-C Coil Cleaning and disinfection at various academic buildings
- Set up Engineering/Controls Department
- Put together long term Utilities and Infrastructure Plan for University.
- Put together long term Upgrade Plans for all campus buildings

- DECLARATION & MANDATE

Declaration

I have read the Strategic Energy & Water Plan for my organization. The plan, as presented, supports reductions required in G.S.143-64.12a.

Implemented September 2017

Commitment

- We recognize that energy and water consumption can be managed to our benefit. Energy and water management is a responsibility of the occupants at each facility, guided and supported by the Energy Manager and/or the USI (Utility Savings Initiative) liaison.
- The attached plan outlines the activities and expenditures required to reduce energy and water consumption to achieve the goals of the program.

Strategic Energy & Water Plan Mandate - Goals

(In accordance with the NC legislative and Executive basis previously described herein)

Reduce annual Total Energy Consumption by a minimum of 40% by fiscal year 2024-2025 from a baseline fiscal year of 2003.

Strategic Energy & Water Plan Mandate - Measures

Our tracking measures will be

Total Energy Use in BTU per Square Foot per Year

Strategic Energy & Water Plan Mandate - Commitment

I have read and support the Strategic Energy & Water Plan for my organization implemented August 2017.

Approval Signature(s)

(Approval is for both the Declaration and the Mandate above)

______________________________ Energy Manager

______________________________ Assoc. VC, Facilities

______________________________ Vice Chancellor, Business Affairs

Focus A: SUPPLY SIDE

FY 20-21 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Check for billing errors		Monthly review		None	20 hours	Facilities	Salary
Meter verification		Quarterly		Several suspect sub-meters were identified and corrective action taken	20 hours	Facilities	Salary

Planned FY 21-22 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Check for billing error and meter verification	Monthly				30 hours	Energy Manager	Salary
Review continued use of marketer vs. utility for natural gas purchases	1 per year		$30,000		8 hours	Physical Plant	Salary
Conduct review of complete sub-metering system to ensure data is available remotely wherever possible, check data accuracy, etc.			Will allow accurate data collection and correct billing errors			Physical Plant	Salary budget

FOCUS B: DEMAND SIDE

FY 20-21 Activities	Measurement		Annual Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Friday Hall Boiler Replacement	Annual		$15,292		$174,814	Energy Manager	1292
Trask AHU	Annual		$3,335		$176,231	Energy Manager	1292, R&R

Planned FY 21-22 Activities	Measurement		Savings		Cost	Assigned to	Funding Source
	Expected	Actual	Expected	Actual			
Replace several inaccurate sub-meters used for billing to internal campus customers	Monthly		??		$10,000	Facilities	TBD
Minimize the use of space heaters throughout campus	Monthly inspection		$5000		50 hours	Business Affairs	Salary budget
Investigate feasibility of implementing demand control	Monthly review		$25,000		$25,000	Facilities	TBD
Installation of Demonstration solar PV	Monthly		$2,500		50000	Energy Manager	Student Green Funding
Investigation of Renewable Energy Opportunities.			???		???	Energy Manager	???
Investigation control improvements for regional energy plants	Monthly		$30,000		$200,000	Energy Manager	Capital / R&R / 1292
Bear Hall Boiler Replacement			$8,860		$90,000	Energy Manager	Capital / R&R / 1292
Retro-commission Various Buildings			$70,000		$350,000	Energy Manager	Capital / R&R / 1292
Upgrade Lighting CMS Ops, Oyster Hatchery, Parking			$6,481		$116,445	Energy Manager	Capital / R&R / 1292
Upgrade CHW, HHW, and DHW Systems at Sports Medicine Building			$20,000		$300,000	Energy Manager	Capital / R&R / 1292

FOCUS C: COMMUNICATION & TRAINING

FY 20--21 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Communicate expected results of Performance Contract projects with building occupants	Many contacts	Ongoing	??	TBD	20 hours	Facilities	Salary budget
Met with Housing staff on several occasions to identify projects to reduce monthly energy costs	Monthly	Monthly	??	Capital project being generated for 3 Dorms and CHW/HHW Plant	10 hours	Facilities	Salary budget

Planned FY 21-22 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Provide information to new employees about campus energy costs	12 times		Increased awareness		4 hours	Facilities	Salary budget
Continue to tell customers of campus space temperature standards.	On-going		Increased awareness		6 hours	Facilities	Salary budget
Continue meetings with Housing staff to discuss energy consumption data	Monthly		Make decisions for future projects	TBD	10 hours	Facilities	Salary budget
Publicize successful energy projects through various methods (on campus, local media, etc)			Increased awareness	Increased awareness	10 hours	Facilities	Salary budget

Focus D: Water

FY 20-21 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Accountability	Funding Source
Expand Pond Irrigation from Trask Coliseum to James Hall and across front lawn	Monthly	Monthly	$50,000		$7,800	Landscaping	R&R
Expand Pond Irrigation around Wagoner Dining Hall	Monthly	Monthly	$36,000		$900	Landscaping	R&R

Planned 21-22 Activities	Measurement Expected	Measurement Actual	Savings Expected	Savings Actual	Cost	Assigned to	Funding Source
Expand Pond Irrigation System to Library Commons, Kenan, and DeLoach	Monthly	Monthly	$10,000		$15,000	Landscaping	R&R
Expand Well Irrigation System to School of Education	Monthly	Monthly	$15,000		$10,000	Landscaping	R&R
Expand Pond Irrigation System to Housing Area	Monthly	Monthly	$30,000		$100,000	Landscaping	R&R
Wagoner Central Energy Plant to Village Parking Lot SS	Monthly	Monthly	100,000		100,000	Landscaping	R&R
Green Track Tie In (Track, Softball, Soccer Entrance &Field	Monthly	Monthly	30,000		6,000	Landscaping	R&R

year	name	total utility $	total energy $	total btu	kwh	kwh $	ng therms	ng $	2oil gals	2oil $	propane gals	propane $	kgal water	water sewer $	gsf	construction gsf	renovated A/C gsf
2002-03	UNC Wilmington	$4,594,973	$4,183,096	312,009,125,764	54,777,997	$3,171,476	1,251,066	$1,011,620	0	$0	0	$0	111,049	$411,877	1,937,834	0	0
2003-04	UNC Wilmington	$5,024,377	$4,578,423	315,878,095,362	56,644,518	$3,293,435	1,224,510	$1,283,104	953	$1,503	260	$381	109,431	$445,954	2,042,844	0	0
2004-05	UNC Wilmington	$5,461,252	$5,035,814	334,462,634,646	58,790,273	$3,485,560	1,335,106	$1,546,164	2,593	$4,090	0	$0	100,927	$425,438	2,194,234	0	0
2005-06	UNC Wilmington	$6,305,216	$5,819,083	356,665,765,484	62,664,798	$3,931,897	1,426,857	$1,883,943	989	$2,707	334	$536	112,160	$486,133	2,579,000	0	0
2006-07	UNC Wilmington	$6,913,056	$6,206,573	397,575,530,782	67,048,936	$4,563,704	1,687,581	$1,642,192	335	$677	0	$0	140,382	$706,483	2,935,001	0	0
2007-08	UNC Wilmington	$7,553,608	$6,771,936	404,891,148,976	72,108,933	$5,068,098	1,586,638	$1,699,330	1,382	$4,508	0	$0	154,807	$781,672	3,047,215	0	0
2008-09	UNC Wilmington	$7,228,146	$6,546,751	381,042,138,460	71,915,955	$5,320,135	1,356,649	$1,226,616	0	$0	0	$0	133,008	$681,395	3,303,907	101,458	30,081
2009-10	UNC Wilmington	$7,575,106	$6,806,789	428,199,570,679	74,226,280	$5,686,770	1,749,154	$1,119,398	0	$0	263	$621	144,721	$768,316	3,728,109	0	0
2010-11	UNC Wilmington	$7,443,987	$6,502,579	411,542,508,648	72,530,379	$5,489,054	1,639,371	$1,010,991	950	$2,534	0	$0	165,005	$941,408	3,692,732	0	0
2011-12	UNC Wilmington	$7,348,125	$6,232,953	397,115,995,226	71,737,753	$5,381,834	1,521,289	$845,874	1,571	$5,245	0	$0	168,584	$1,115,172	3,824,972	0	67,360
2012-13	UNC Wilmington	$7,292,192	$6,311,731	407,827,581,536	71,975,831	$5,403,168	1,618,566	$900,091	2,699	$8,250	165	$222	147,479	$980,461	3,977,995	0	0
2013-14	UNC Wilmington	$7,584,074	$6,674,317	406,742,227,902	75,002,326	$5,725,493	1,506,386	$944,045	1,411	$4,779	0	$0	137,257	$909,757	3,978,116	46,714	0
2014-15	UNC Wilmington	$7,560,049	$6,598,713	425,198,543,168	74,355,464	$5,802,399	1,714,977	$796,314	0	$0	0	$0	141,650	$961,336	3,986,810	0	4,454
2015-16	UNC Wilmington	$7,509,526	$6,538,267	433,180,643,980	77,369,415	$5,796,850	1,691,962	$741,416	0	$0	0	$0	135,561	$971,259	3,991,136	9,836	0
2016-17	UNC Wilmington	$7,129,932	$6,244,737	409,050,844,708	73,662,696	$5,333,883	1,574,374	$907,538	1,992	$3,316	0	$0	126,624	$885,195	4,006,035	0	0
2017-18	UNC Wilmington	$6,950,625	$6,171,611	405,140,677,980	69,838,915	$5,223,739	1,668,503	$947,872	0	$0	0	$0	106,735	$779,014	3,987,923	182,595	0
2018-19	UNC Wilmington	$7,192,789	$6,165,440	364,419,381,928	66,235,194	$5,338,311	1,384,249	$827,130	0	$0	0	$0	146,209	$1,027,349	3,960,221	362,080	110,951
2019-20	UNC Wilmington	$6,774,746	$5,895,389	365,516,219,093	64,758,299	$5,206,301	1,439,334	$679,310	4,525	$9,778	0	$0	126,084	$879,357	3,991,200	584,845	110,951
2019-20	UNC Wilmington	$7,187,625	$6,282,150	382,338,211,189	63,126,324	$5,469,147	1,662,088	$799,886	5,353	$13,117	0	$0	108,302	$905,475	4,837,267	223,092	0

		energy evaluation						water/sewer evaluation				
		energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
2002-03	UNC Wilmington		$2.16	$13.41		161,009			$3.71		57.31	
2003-04	UNC Wilmington	$188,985	$2.24	$14.49	8%	154,627	-4%	$31,117	$4.08	10%	53.57	-7%
2004-05	UNC Wilmington	$283,501	$2.30	$15.06	12%	152,428	-5%	$104,604	$4.22	14%	46.00	-20%
2005-06	UNC Wilmington	$955,697	$2.26	$16.32	22%	138,296	-14%	$154,437	$4.33	17%	43.49	-24%
2006-07	UNC Wilmington	$1,170,621	$2.11	$15.61	16%	135,460	-16%	$139,958	$5.03	36%	47.83	-17%
2007-08	UNC Wilmington	$1,434,005	$2.22	$16.73	25%	132,873	-17%	$100,057	$5.05	36%	50.80	-11%
2008-09	UNC Wilmington	$2,592,937	$1.98	$17.18	28%	115,331	-28%	$288,550	$5.12	38%	40.26	-30%
2009-10	UNC Wilmington	$2,735,123	$1.83	$15.90	19%	114,857	-29%	$365,897	$5.31	43%	38.82	-32%
2010-11	UNC Wilmington	$2,891,830	$1.76	$15.80	18%	111,447	-31%	$265,924	$5.71	54%	44.68	-22%
2011-12	UNC Wilmington	$3,433,240	$1.63	$15.70	17%	103,822	-36%	$334,774	$6.61	78%	44.07	-23%
2012-13	UNC Wilmington	$3,600,852	$1.59	$15.48	15%	102,521	-36%	$535,060	$6.65	79%	37.07	-35%
2013-14	UNC Wilmington	$3,835,998	$1.68	$16.41	22%	102,245	-36%	$601,250	$6.63	79%	34.50	-40%
2014-15	UNC Wilmington	$3,363,223	$1.66	$15.52	16%	106,651	-34%	$589,201	$6.79	83%	35.53	-38%
2015-16	UNC Wilmington	$3,161,043	$1.64	$15.09	13%	108,536	-33%	$667,427	$7.16	93%	33.97	-41%
2016-17	UNC Wilmington	$3,602,226	$1.56	$15.27	14%	102,109	-37%	$719,662	$6.99	88%	31.61	-45%
2017-18	UNC Wilmington	$3,609,545	$1.55	$15.23	14%	101,592	-37%	$888,937	$7.30	97%	26.76	-53%
2018-19	UNC Wilmington	$4,622,357	$1.56	$16.92	26%	92,020	-43%	$567,287	$7.03	89%	36.92	-36%
2019-20	UNC Wilmington	$4,469,389	$1.48	$16.13	20%	91,581	-43%	$715,807	$6.97	88%	31.59	-45%
2020-21	UNC Wilmington	$6,514,944	$1.30	$16.43	23%	79,040	-51%	$1,412,124	$8.36	125%	22.39	-61%

		$/kwh	$/therm	2 oil $/gal	6 oil $/gal	propane$/gal	coal $/ton	wood $/ton	steam $/mlb	chw $/ton
2002-03	UNC Wilmington	$0.0579	$0.809	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2003-04	UNC Wilmington	$0.0581	$1.048	$1.58	$0.00	$1.47	$0.00	$0.00	$0.00	$0.00
2004-05	UNC Wilmington	$0.0593	$1.158	$1.58	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005-06	UNC Wilmington	$0.0627	$1.320	$2.74	$0.00	$1.60	$0.00	$0.00	$0.00	$0.00
2006-07	UNC Wilmington	$0.0681	$0.973	$2.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007-08	UNC Wilmington	$0.0703	$1.071	$3.26	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008-09	UNC Wilmington	$0.0740	$0.904	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009-10	UNC Wilmington	$0.0766	$0.640	$0.00	$0.00	$2.36	$0.00	$0.00	$0.00	$0.00
2010-11	UNC Wilmington	$0.0757	$0.617	$2.67	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2011-12	UNC Wilmington	$0.0750	$0.556	$3.34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2012-13	UNC Wilmington	$0.0751	$0.556	$3.06	$0.00	$1.35	$0.00	$0.00	$0.00	$0.00
2013-14	UNC Wilmington	$0.0763	$0.627	$3.39	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2014-15	UNC Wilmington	$0.0780	$0.464	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2015-16	UNC Wilmington	$0.0749	$0.438	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2016-17	UNC Wilmington	$0.0724	$0.576	$1.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2017-18	UNC Wilmington	$0.0748	$0.568	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2018-19	UNC Wilmington	$0.0806	$0.598	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2019-20	UNC Wilmington	$0.0804	$0.472	$2.16	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2020-21	UNC Wilmington	$0.0866	$0.481	$2.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Cost per Therm (100,000 Btu) all Energy Sources								
2002-03	UNC Wilmington	$1.70	$0.81	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2003-04	UNC Wilmington	$1.70	$1.05	$1.13	$0.00	$1.59	$0.00	$0.00	$0.00	$0.00
2004-05	UNC Wilmington	$1.74	$1.16	$1.13	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005-06	UNC Wilmington	$1.84	$1.32	$1.96	$0.00	$1.74	$0.00	$0.00	$0.00	$0.00
2006-07	UNC Wilmington	$1.99	$0.97	$1.44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007-08	UNC Wilmington	$2.06	$1.07	$2.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008-09	UNC Wilmington	$2.17	$0.90	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009-10	UNC Wilmington	$2.25	$0.64	$0.00	$0.00	$2.57	$0.00	$0.00	$0.00	$0.00
2010-11	UNC Wilmington	$2.22	$0.62	$1.91	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2011-12	UNC Wilmington	$2.20	$0.56	$2.38	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2012-13	UNC Wilmington	$2.20	$0.56	$2.18	$0.00	$1.46	$0.00	$0.00	$0.00	$0.00
2013-14	UNC Wilmington	$2.24	$0.63	$2.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2014-15	UNC Wilmington	$2.29	$0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2015-16	UNC Wilmington	$2.20	$0.44	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2016-17	UNC Wilmington	$2.12	$0.58	$1.19	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2017-18	UNC Wilmington	$2.19	$0.57	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2018-19	UNC Wilmington	$2.36	$0.60	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2019-20	UNC Wilmington	$2.36	$0.47	$1.54	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2020-21	UNC Wilmington	$2.54	$0.48	$1.75	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Updated Strategic Energy Plan

With Usage from FY 2020-21

Submitted September 1st, 2021

Office of Sustainability & Energy Management

Facilities Management

Prepared by: David King, C.E.M.

Special thanks to our controls technician Duane Strain, as well as our HVAC, Plumbing, and Electric Shops who are a daily reminder that "No one of us is as smart as all of us"

Western Carolina UNIVERSITY

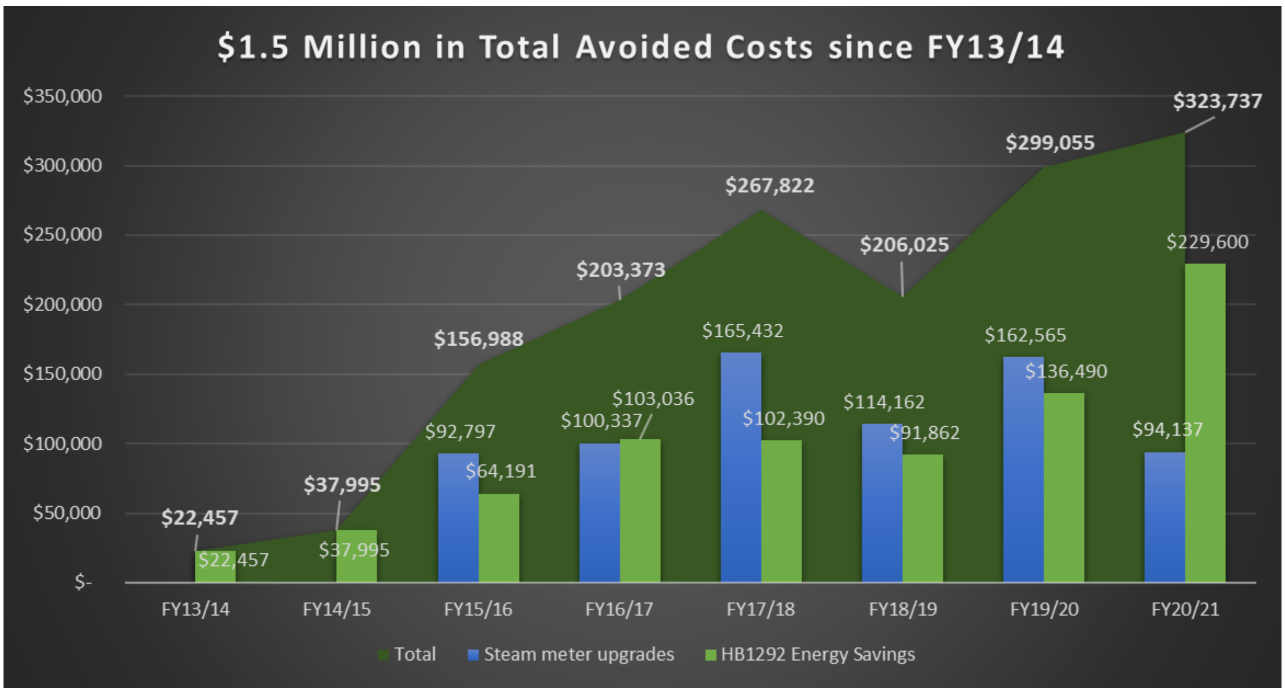
Executive Summary

Approach

Commercial buildings waste on average 30% of their energy (DOE, 2019). WCU's approach to energy management therefore focuses on demand-side management by implementing no-cost to low-cost proven conservation and energy efficiency measures first. This is accomplished via the building automation system (BAS) which is software that operates two-thirds of the campus heating, ventilation, and air conditioning (HVAC) which can represent 40-50% of a building's total energy usage (EIA, 2017).

"*You can't manage what you don't measure*." While this is an old business adage, it is central to energy management at WCU. Investments in metering have allowed WCU to benchmark energy usage for 95% of the 40 largest buildings on campus compared to 12% in FY12/13. This has brought to light that five buildings account for almost 25% of all utility costs on campus (see pg. 6)

Summary of Fiscal Year 20/21:



- Total avoided costs of over $1.5 million since 2013 ($800,000 in energy savings, $700,000 in recovered steam plant operational costs)

- Submitted $229,000 in House Bill 1292 energy savings carry forward (13 projects compared to 9 for the previous year). For perspective, the electric savings alone (2.7 million kWh) would require over $4,000,000 in solar to generate.

- Recovered $94,137 in steam plant operations (over $700,000 in recovered steam plant operational costs since 2013)

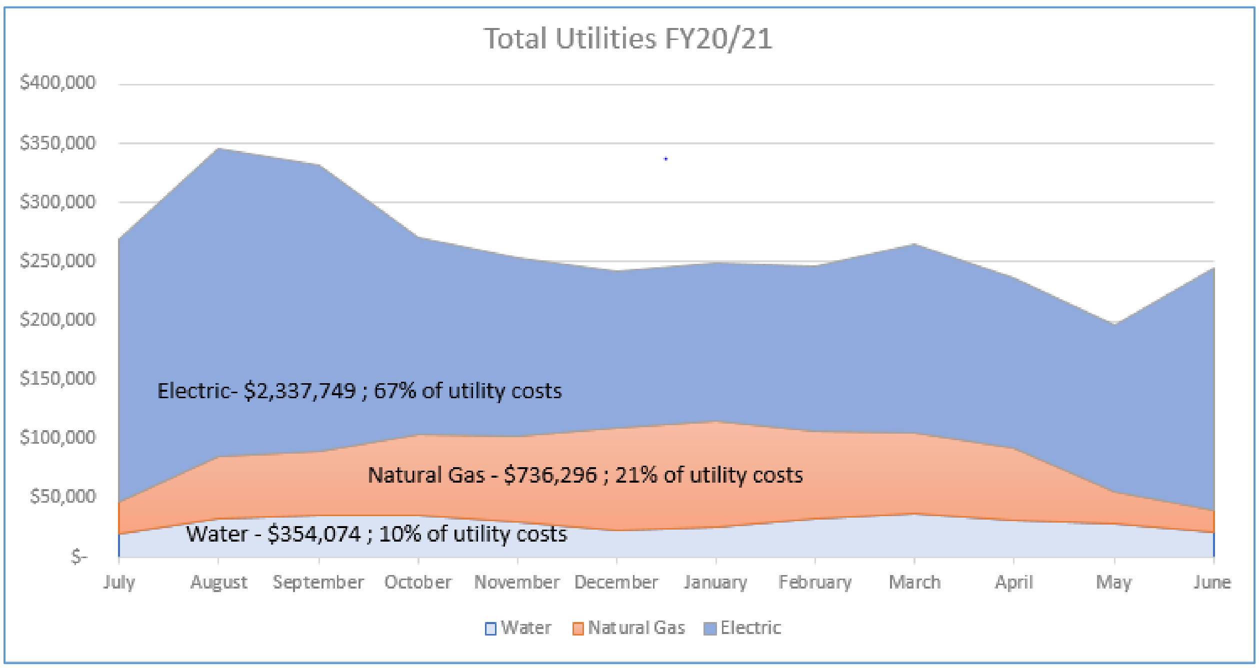
- Replaced 1990's era controls at the Hunter chiller plant and have reduced usage by almost 50% in the first 6 months for an avoided cost of over $30,000. As of July, the largest chiller is now only used for redundancy. On the older system, it was not uncommon to see all three chillers running.

- Completed controls upgrade of the Ramsey Arena air handlers from pneumatic to direct digital control (DDC) and replaced original hot water and chilled water valves on all 7 units.

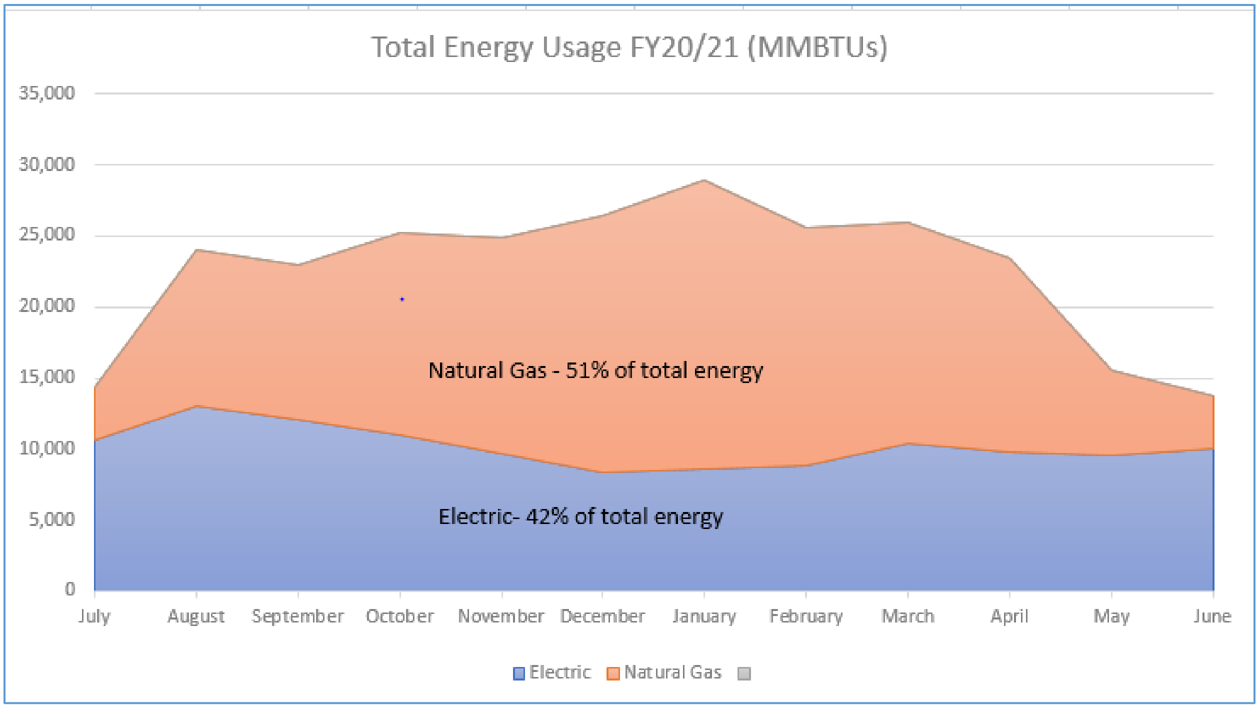
- Replaced failed controller on air handler three at Stillwell before Christmas. With the new controller, we can now un-occupy the entire academic wing of Stillwell which was previously running 24/7. This has reduced usage by approximately 10% for an avoided cost of around $10,000.

- Worked with design engineers, commissioning agents, and controls contractors over the past 5 years on the HVAC and lab ventilation systems at the Apodaca Science Building. The most complex building on campus is finally online and utilizes an energy recovery loop to recover thermal energy exhausted by the laboratories to preheat or precool incoming air.

- Total Utilities for FY20/21 - $3.5 million (electric - $2.3 million ; natural gas - $736,000 ; water - $356,000)

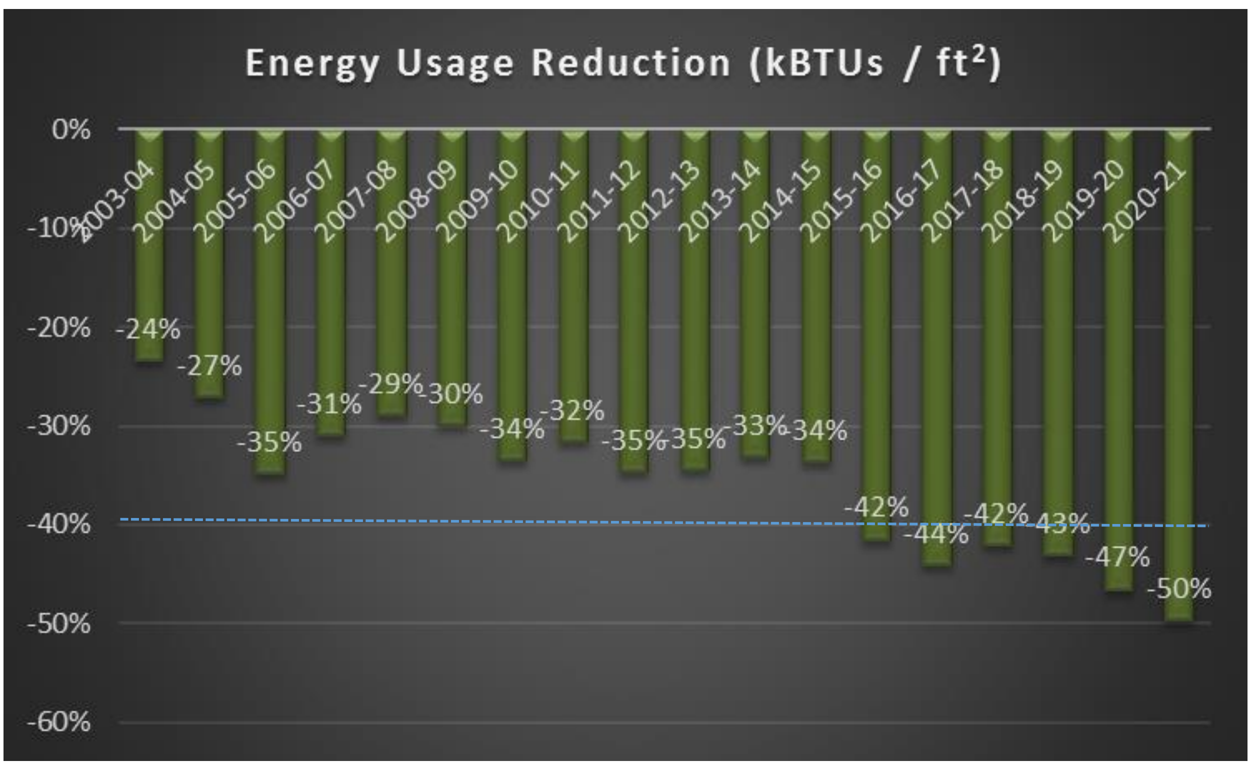


Electricity accounts for two-thirds of all utility costs…..



However, electricity is less than half of total energy usage; more financial savings by reducing electricity, but more energy savings by reducing natural gas usage. Electric usage does not account for source usage and inefficiencies.

FY20/21 Usage



WCU currently stands at a 50% reduction in energy usage intensity (EUI or how much energy we use per square foot of campus) compared to the baseline year of 2002-2003 and continues to exceed the State Energy Office's Utility Savings Initiative of 40% by 2025. Certainly, COVID has contributed to this year's reduction, typical electric bills for campus were down 25% starting in April of 2020 (see Addendum for long-term energy trends starting on p.23).

To reduce campus EUI by just 1% requires a reduction of 6 billion British Thermal Units or BTUs (1 match represents the equivalent energy in 1 BTU). For perspective, that's roughly the same reduction as 1,800,000 kWh (over $100,000 in electrical usage) or 60,000 therms (almost $30,000 in natural gas).

Overall campus electric demand (kW) is also trending downward despite a 25% increase in building square footage and an additional 4,000 students (40% increase) since FY2005/2006. The graph below is compressed to show 12 months which can exaggerate trends and doesn't factor weather, but in general the overall monthly demand is trending downward before and after COVID (e.g. for April-June the uptick in electric demand since students and staff have returned is still lower than in previous years).

The highest peak demand of 8,640 kW was back in August of 2013 (monthly cost of over $300K). For perspective, if the average person can maintain 100 watts on a bicycle, it would require 86,400 people (pedaling) to meet a campus demand of 8,640 kW.

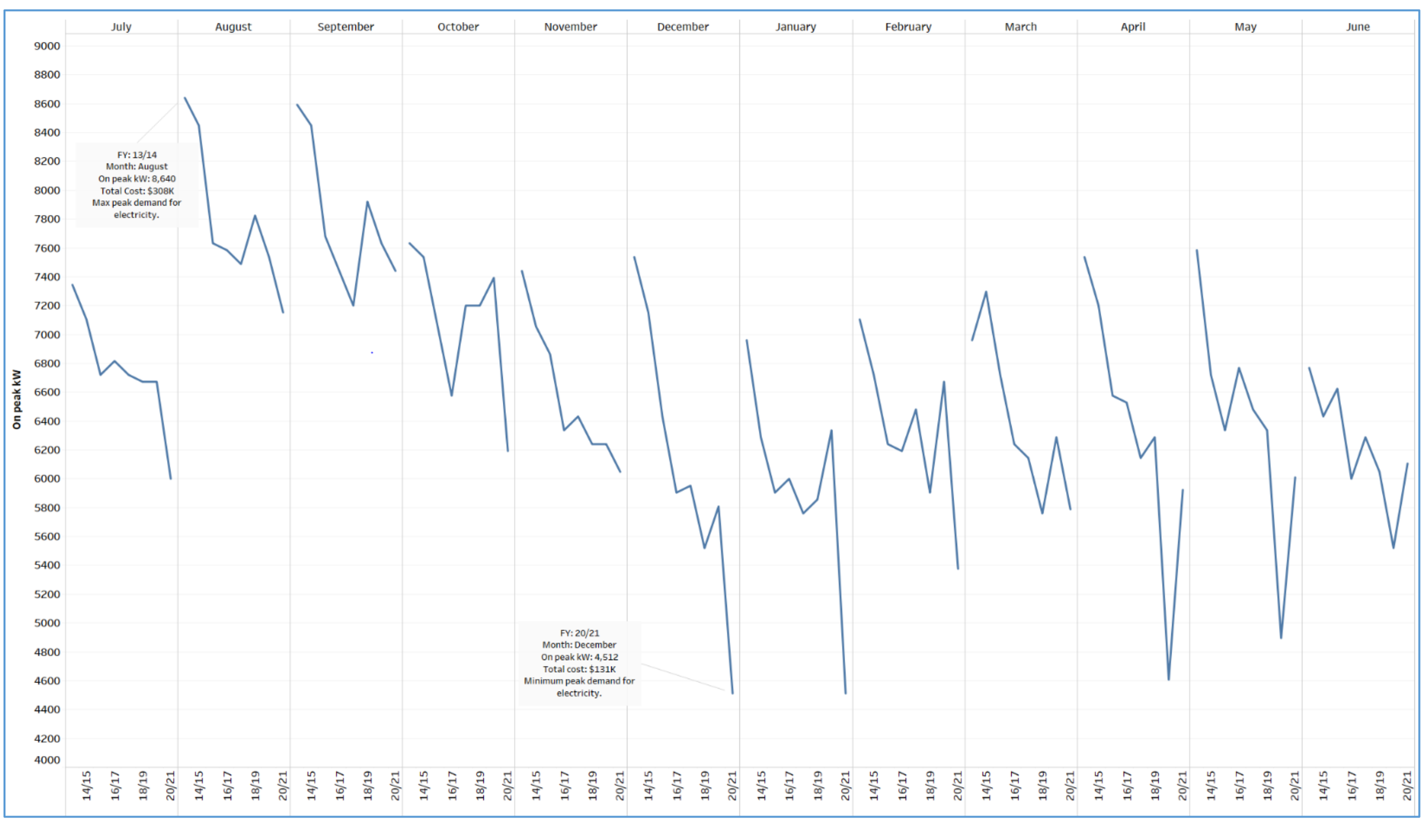


Tableau graph courtesy of Nathan Hodges and Alison Joseph

Building Usage

Of the 40 largest buildings on campus, five account for almost 25% for all utility costs (energy and water), the top 15 buildings account for 50% of campus utilities. Continued focus on the top tier of the most expensive buildings will yield the greatest financial, energy, and CO_2 savings.

Building	Built / Last Major Renovation	Utility Cost		% of Campus Cost
Hunter Library	1982	$	260,628	6.4%
Ramsey Arena Center	1986	$	194,446	4.8%
Health and Human Sciences	2012	$	177,389	4.4%
Belk Building*	1971	$	166,567	4.1%
Stillwell Science Building	2008	$	166,406	4.1%
Bardo Arts Center*	2004	$	165,592	4.1%
Courtyard Dining Hall*	2009	$	151,939	3.7%
Natural Science Building	1977	$	140,015	3.4%
Coulter Building	1978	$	110,326	2.7%
Balsam Residence Hall	2009	$	97,222	2.4%
Allen Residence Hall*	2019	$	92,092	2.3%
Campus Rec Center	2008	$	86,772	2.1%
Brown Dining Hall	2017	$	85,776	2.1%
Hinds University Center*	1968	$	79,010	1.9%
Albright-Benton Residence Hall	1962	$	69,613	1.7%

Top 5 buildings represent 24% of campus utilities $965,436

Top 15 buildings represent 50% of campus utilities $2,043,792

**meter data incomplete due to steam condensate leak or electric meter failure*

"Bigger targets = bigger opportunities" – *Patrick Richardson*

Opportunities and status of the top 10 most expensive buildings are as follows:

- **1) Hunter Library** - **$260,628** – Previously Hunter Library had a total utility cost over $300,000, a second portable meter found the steam data to be suspect, replacement of the existing steam condensate line is pending. A BAS upgrade of the chiller plant along with BTU meter upgrades have reduced usage on that plant by 50% and saved over $30,000 in the first six months (see page 16 for details). A major renovation of the building mechanical systems is needed. Last major renovation was 38 years ago, in 1982.

- **2) Ramsey Arena Center – $194,446 -** With the third phase of the VFD / BAS controls upgrade complete, Ramsey has an avoided electrical cost of over $100,000 to date (page 20). Phase 4 and 5 will include replacing the pneumatic controls on the concourse and office areas.

- **3) Health and Human Science Building – $177,389 -** Despite housing an anatomy lab, campus servers, multiple hoods, and a PT clinic with therapy pool, HHS operates at an ENERGY STAR level for an office building (25th percentile of energy usage compared to similar building stock). This performance is due to a building tune-up project initiated in 2015 along with the implementation of scheduling software (Events2HVAC) to heat and cool spaces as needed using the 25Live schedule. Continued vigilance is still needed to maintain the 30% reduction and $50,000 in annual savings. The oversized chiller and needs of the Anatomy Lab also require monitoring to balance dehumidification and prevent over-cycling of the chiller. Post-COVID (when…?), an additional 20-30% could be saved by un-occupying non-critical areas over the weekends during spring, fall, and winter (reducing operating days from 7 to 5 days a week).

- **4) Belk Building – $166,567 -** Built in 1971, Belk would need a major mechanical renovation to achieve significant energy savings. Improved scheduling has already reduced run hours by 30%. Cost above is prior to scheduling adjustment, building meter failed one month after adjustment. While a new meter has been installed, additional configuration is still needed.

- **5) Stillwell Science Building – $166,406 -** This building is scheduled for a partial backfill once the Apodaca Science Building is completed as some of the existing hoods will be removed as classes move to Apodaca. The recent emergency replacement of the controls on air handler 3 has allowed us to un-occupy the academic wing which was previously running 24/7. To date, this has reduced usage by approximately 10% for an avoided utility cost of around $10,000.

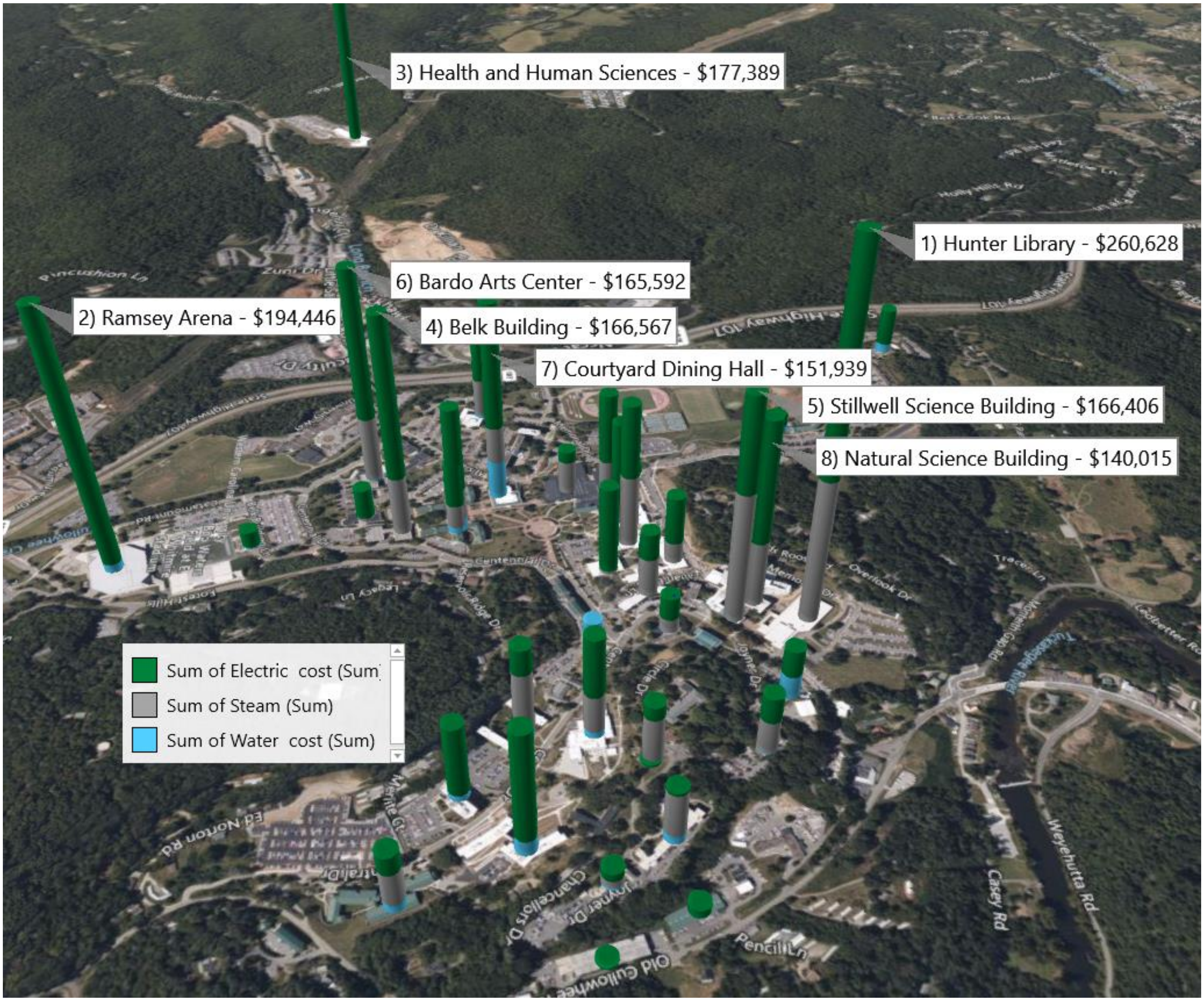
- **6) Bardo Arts Center** – **$165,592** - BAS upgrade to just the Museum took place in 2019 to help improve the humidity control necessary for accreditation (many museums and collections require a history of temperature and humidity control before loaning out works of art). While additional programming software and training was purchased to initiate a building tune-up, progress continues to be slow. While completed in the early 2000's the BAS technology is from the late 90s and is cumbersome to work with even for experienced vendors (if you can imagine meeting your current office demands while still using Windows 95). Maintenance contract with BAS vendor will focus on continuing the building tune-up. By simply running the Theatre HVAC for events only (previously running 7am-10pm) has saved over $12,000 a year (over $60,000 to date).

- **7) Courtyard Dining** – **$151,939** - The most expensive building per square foot on campus. The campus average for utilities is less than $1.00 /ft^2 while Courtyard is over $4.00 / ft^2 (in fairness it is a dining hall, however, it's energy usage intensity is still above the nation median value for dining halls). A feasibility study is still needed to see if make-up air can be provided directly to the existing kitchen hoods. Currently all make-up air for the kitchen area is conditioned air (heated and cooled) provided by the building's two air handlers (instead of make-up air at the kitchen exhaust). This creates comfort issues when hot, humid outside air must be conditioned and supplied to the kitchen, in addition to the full load created by occupants. A BAS upgrade is also on the horizon.

- **8) Natural Science Building – $140,015 -** built in 1977, scheduled for demolition in 2021. Despite having 21 buildings on campus larger than NSB, it was fourth on the list for using the most steam of any building on campus last year, demonstrating how energy intensive an inefficient science building can be.

- **9) Coulter Building – $110,326 -** Built in 1978, the current HVAC system is all pneumatic and requires a major renovation.

- **10) Balsam Residence Hall – $97,222 -** Balsam is in the top 10 as it houses a chiller plant for both itself, Blue Ridge Residence Hall, and Courtyard Dining. While Courtyard chilled water usage has been accounted for, further refinement is needed to separate chilled water usage from Balsam and Blue Ridge. Opportunities to un-occupy (relax the cooling setpoints) for the majority of the rooms exist over the summer when the building is used periodically for conferences. This opportunity also exists for Blue Ridge and Harrill Residence Halls and only requires minor coordination to arrange, as it can be done remotely.



Utility costs totaled– Excel 3D maps

Focus for FY2020/2021

- Continue to replace building automation systems (BAS) greater than 15 years of age that no longer have building level controllers available or whose database cannot be supported with campus migration to latest version of Windows server. Capture associated energy savings with House Bill 1292 to fund future BAS upgrades (which has grown from $22,000 in FY13/14 to over $229,600 in FY20/21)
    - Implement phase 4 of BAS upgrade at Ramsey Arena; replace original pneumatic controllers on the two air handlers and 40 plus zone controllers serving the Concourse; replace pneumatic controls on the auxiliary gym.
    - Review the existing BAS system at Bardo Arts Center and obtain quotes for phased upgrade.
    - Replace the aged pneumatic system on steam heat exchanger at Reid Gym.

- Provide support for the HVAC, lab ventilation, and energy recovery loop at the Apodaca Science Building (an additional 2,400 points of data to manage). This building continues to require a large amount of time to fine-tune and to establish the baseline performance of the lab ventilation system (i.e. snapshot of the current system capacity so we can monitor for degrade over time).

- Roll out weekend schedule on 11 academic buildings which currently run all weekend regardless of occupancy (estimated savings of $100,000). A rough estimate shows a potential CO_2 reduction of 5% needed toward Executive Order 80. – *Rollout delayed due to COVID- 8/26/21*

- Create video content on Building Tune-Ups as part of the UNC Energy Managers sub-group.

- Refine existing alarm management program within the BAS to only generate alarms on primary equipment (chiller, boilers, air handlers) that need immediate response from HVAC shop.

- Install ultrasonic meter at Balsam cooling towers, currently un-metered. Estimated $5,000 - $6,000 in potential annual avoided sewer charges based on other cooling tower data. This has been on the list for a few years, but is usually de-prioritized as more immediate issues come up on campus (e.g. mechanical / controls failures, humidity control issues, COVID).

This will be in addition to maintaining daily operations on over 2.2 million ft^2 of BAS systems and 180 electric and water meters across campus.

Executive Order 80

year	gsf	gsf % change	construction gsf	Students	Students % change	CO_2 lbs. kWh	CO_2 lbs. NG therms	CO_2 lbs. #2 Oil	CO_2 lbs. #6 Oil	CO_2 lbs. Propane	CO_2 lbs. Total	CO_2 % change
2005-06	2,734,121		14,655	8,665		68,538,629	5,257,404	759,830	20,029,542	320,510	94,905,915	
2006-07	2,843,308	4.0%	0	8,861	2.3%	65,882,093	20,665,539	731,002	3,817,034	357,454	91,453,121	-3.6%
2007-08	2,790,749	2.1%	0	9,056	4.5%	65,006,558	23,934,327	625,231	92,014	302,945	89,961,075	-5.2%
2008-09	2,863,949	4.7%	0	9,050	4.4%	66,456,162	23,750,925	809,899	765,050	1,114	91,783,149	-3.3%
2009-10	2,798,946	2.4%	0	9,429	8.8%	69,653,626	20,087,158	588,213	195,000	382,213	90,906,210	-4.2%
2010-11	2,911,228	6.5%	0	9,407	8.6%	69,937,987	22,517,452	1,010,464	78,000	335,979	93,879,881	-1.1%
2011-12	2,954,814	8.1%	0	9,352	7.9%	71,157,749	21,109,898	884,995	0	313,850	93,466,492	-1.5%
2012-13	3,105,538	13.6%	0	9,608	10.9%	73,898,717	22,768,116	523,248	26,000	357,638	97,573,720	2.8%
2013-14	3,103,210	13.5%	0	10,107	16.6%	74,817,034	21,782,005	442,225	2,548,468	389,486	99,979,218	5.3%
2014-15	3,103,210	13.5%	0	10,382	19.8%	73,486,895	22,803,832	501,939	1,040,000	269,582	98,102,247	3.4%
2015-16	3,103,210	13.5%	0	10,340	19.3%	67,959,905	19,803,062	471,363	52,000	316,827	88,603,157	-6.6%
2016-17	3,223,781	17.9%	120,571	10,805	24.7%	67,853,607	19,649,696	534,038	52,000	153,929	88,243,271	-7.0%
2017-18	3,282,381	20.1%	58,600	11,034	27.3%	66,301,919	22,128,996	510,720	52,000	172,493	89,166,128	-6.0%
2018-19	3,282,381	20.1%	0	11,639	34.3%	65,906,644	21,543,836	545,552	52,000	108,908	88,156,939	-7.1%
2019-20	3,447,994	26.1%	165,613	12,167	40.4%	63,909,231	18,813,075	443,363	4,241,250	84,734	87,491,654	-7.8%
2020-21	3,234,681	18.3%	0	12,243	41.3%	60,021,495	18,014,957	646,195	0	124,572	78,807,219	-17.0%
2021-22	0		0									
2022-23	0		0									
2023-24	0		0									
2024-25	0		0									

North Carolina's greenhouse gas (GHG) emissions goal under EO80 is to reduce emissions by 40% from all economic sectors by 2025.

1.559 lbs CO_2 / kWh
11.71 lbs CO_2 / CCF or 1 therm
22.4 lbs CO_2 / gallon of #2 oil
26 lbs CO_2 / gallon of #6 oil
12.7 lbs CO_2 / gallon of propane

https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
https://www.eia.gov/environment/emissions/co2_vol_mass.php
https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

The Governor's Executive Order 80 calls for a 40% reduction in CO_2 emissions compared to a base year of 2005. WCU is currently at a 17 % reduction which due to COVID is an artificial number. This is based on total energy consumption and emissions instead of energy or CO_2 per square foot. Campus square footage and student enrollment have grown 25% and 40% respectively, since the baseline year in 2005. Many universities that in good stewardship have pledged to be CO_2 neutral by 2030 or 2040 are not close to meeting this goal. Of the 450 colleges and universities that pledged to be carbon neutral only seven have reached carbon neutrality and all seven used carbon offset purchases (Second Nature, 2020).

However, there are cost effective opportunities to reduce emissions, save on utilities, and extend the life of mechanical equipment. *How then do we prioritize resources, both time and fiscal?* Below is list of executed projects on campus along with their financial and emissions impact. The last column shows the pounds of CO_2 reduced per dollar spent on project in order of the most cost effective to least.

Project	Description	Annual Savings	Investment	Savings to Investment Ratio (SIR) or ROI	Simple Payback (years)	Total Reduction CO_2 Lbs.	Cost effectiveness CO_2 Reduction Lbs. per dollar spent
Campus Scheduling	unoccuping weekends for non	$ 100,000	time		immediate	4,000,000	very
Events to HVAC	Space scheduling software	$ 23,110	$ 5,013	461%	0.22	418,933	83.6
HHS Re-tuning	Optimization and calibration o	$ 30,000	$ 30,996	97%	1.03	623,600	20.1
Steam meter upgrade	Campus-wide upgrade to ultra	$ 127,059	$ 230,400	55%	1.81	n/a	n/a
Ramsey VFD install	Added VFDs to 25 air handlers	$ 25,000	$ 250,000	10%	10.00	593,904	2.4
LED campus upgrade	Performance contract*	$ 219,228	$ 3,300,000	7%	15.05	4,925,749	1.5
Solar installation	10 kW	$ 900	$ 25,000	4%	27.78	14,776	0.6

**LED savings compare 12 months prior and post installation and do not include maintenance savings ; solar installation cost does not include structural cost for solar lounge which are unique*

One of the greatest opportunities not yet executed would be to relax heating and cooling setpoints on the weekends in non-critical areas of 11 academic and office buildings (e.g. Forsyth, Belk, Killian, Killian Annex, Bardo, Breese, McKee, CAT, HFR, Old Student Union, and HHS). This would involve coordination to identify critical areas (e.g. radio station at Old Student Union), but simply going from running equipment 7 days a week to 5 days is a 28% reduction in run time and associated emissions for a potential avoided cost of over $100,000 and a campus reduction of another 5% or 4,000,000 lbs. of CO_2 (see pg. 27 for calculation).

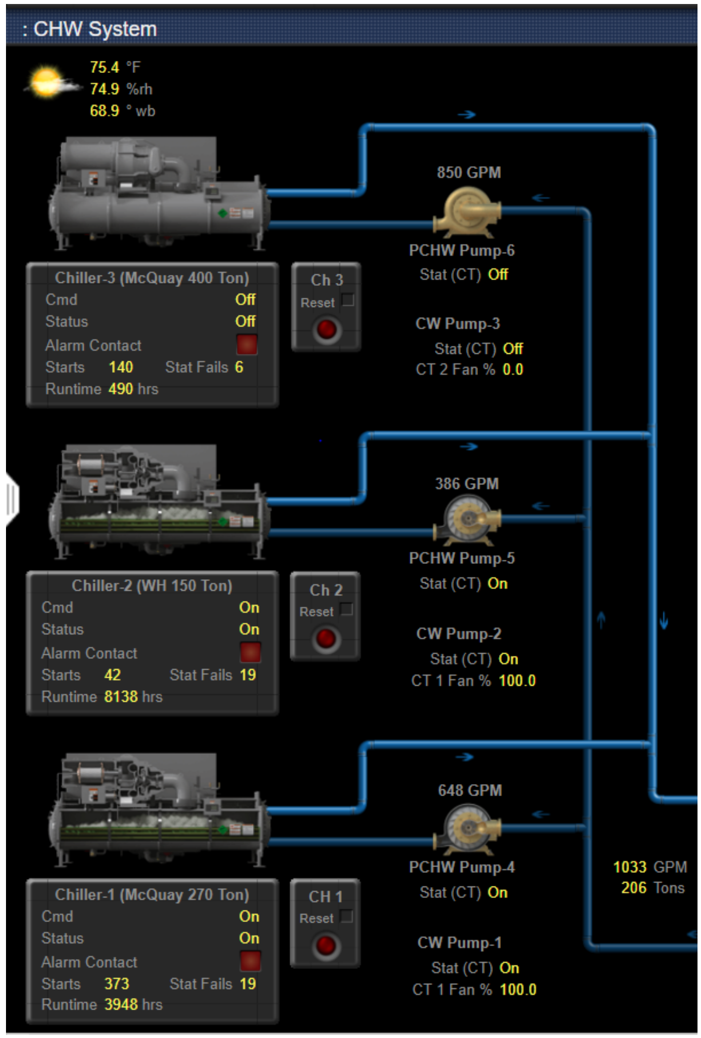
For buildings with newer BAS systems, if weekend or after hours' events are in 25Live (classroom scheduling software), that schedule can be pushed down to the building level controllers with third party software (Events2HVAC). This already has a successful track record as demonstrated at HHS (see cash flow chart on pg. 21). One of the best complements came from Dean Keskula who when asked many months later about the project had forgotten about the installation of Events2HVAC. This is more than understandable given his responsibilities, but demonstrates how such projects can be executed with minimal disruption. Staff there were consulted before proceeding and critical areas such as server rooms and laboratories were excluded from the project.

CO_2 sensors are used across campus to monitor indoor air quality and to increase outside air when levels increase. A typical range is around 400 parts per million (ppm). When converted to a percentage this is 0.04 % or 4 one-hundredths of 1 percent. This is compared to 78% nitrogen and 21% oxygen that comprise the air we breathe. This small trace amount is what regulates heat in the atmosphere.

Due to continued COVID concerns the implementation of campus weekend scheduling has been delayed.

While solar and renewables dominate the discussion in the media, they have a low amount of savings and emissions reduction on campus (as seen above) given our low commercial utility rates and exemption from federal and state credits. This should not be interpreted as an attack on renewables as they are robust technologies (25-year warranty is standard on most solar panels), however if we are looking to achieve the greatest fiscal savings and reductions in emissions we need to prioritize our projects and resources. Therefore, we approach in the order of conservation, efficiency, and then renewables.

Hunter Library Chiller Plant Controllers Upgrade

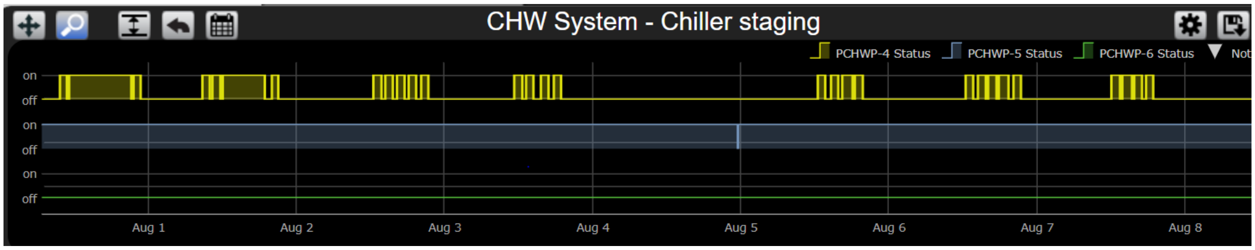


The chilled water plant at Hunter Library provides chilled water for building cooling to Hunter, Stillwell, Hoey, and McKee and was a concern considering the existing control system was at its end of life.

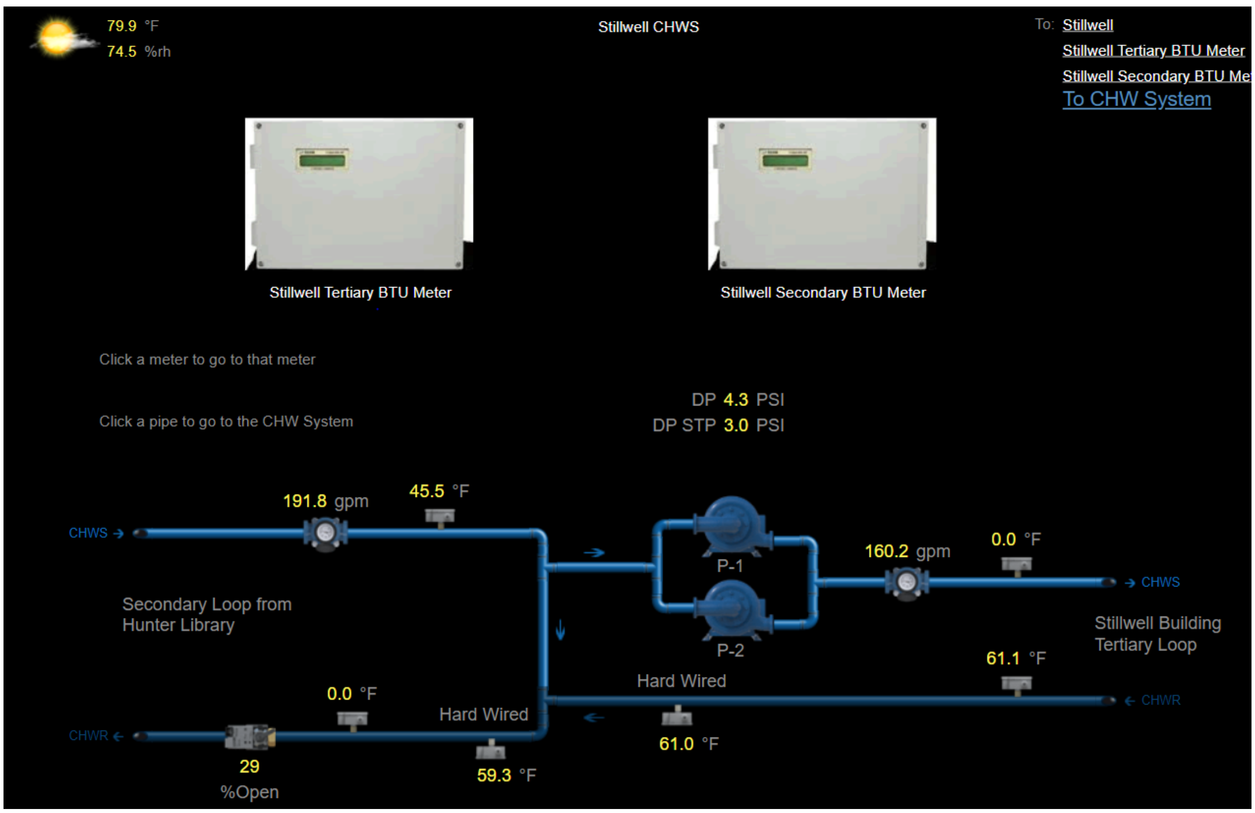
By February of 2021, we had upgraded not only the controls system, but had integrated BTU meters on each branch of the system in order to determine what was driving demand by building. This led to the discovery of a few suspect hot water valves on the air handlers on the West wing of Hunter Library. The aged pneumatic lines were either failing to provide adequate pressure to keep the hot water valves closed or had been manually set to provide comfort during the winter months.

Unfortunately, a complete renovation of the HVAC system at Hunter is needed to completely resolve these issues that are creating a false heating load that requires running the chillers even during winter months. The 1950's pneumatically controlled air handlers are also unable to properly economize or control available outside air for cooling.

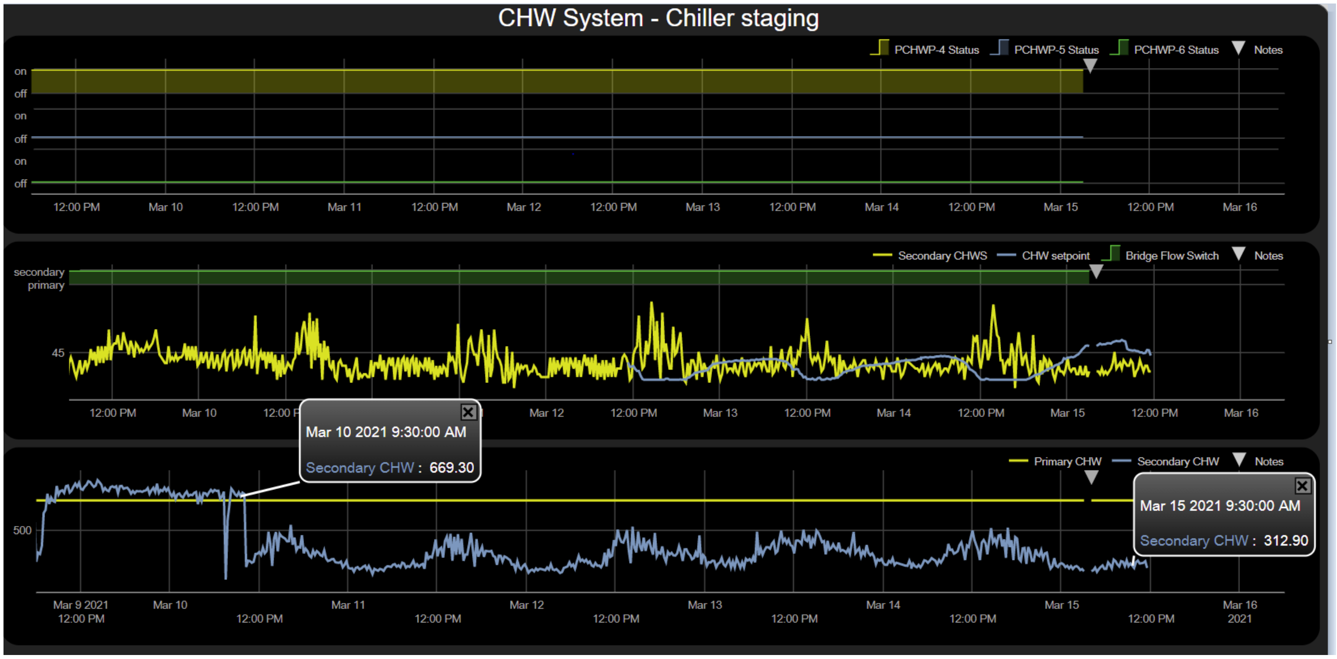
However, despite these discoveries we have been able to reduce usage there by almost 50% for an avoided electric savings of over $30,000 in just six months. After consulting with the chiller service technician, we scheduled the smallest to largest chiller to run in that order to meet the demand from the buildings. Even in the first week of August we are able to meet demand by running the smallest chiller (150 Ton - blue trend below) as the baseload and have the middle-sized chiller (270 Ton – yellow trend) come on-line a few times daily as needed. Note the largest chiller (400 Ton – green trend) has not enabled a single time during this period. On the older control system it was not uncommon to see all three chillers running.



By reviewing the existing system with the original engineer of design we also discovered that the 1990's control system at Stillwell was not operating as intended. We were able to meet the design intent by adding a BTU meter to monitor the chilled water demand at Stillwell and a meter on the branch supplying chilled water to Stillwell. In the screen capture below the building demand at Stillwell is 160.2 gpm which we are able to provide and slightly overflow at 191.8 gpm by controlling the bridge valve to the building to open to 29%.



The previous system was controlling by comparing return temperatures and was providing twice as much chilled water as needed. This excessive amount of chilled water was then returned to the chiller at a temperature much less than design which reduced the cooling capacity of the chiller and in some instances would require an additional chiller to run. On the screen capture below, note the drop in demand on the entire system from 600 gpm to 300 gpm on March 10th once the new program at Stillwell was downloaded.


CHW System - Chiller staging
PCHWP-4 Status
PCHWP-5 Status
PCHWP-6 Status
Notes
on
off
on
off
on
off
12:00 PM
Mar 10
Mar 11
Mar 12
Mar 13
Mar 14
Mar 15
Mar 16
Secondary CHWS
CHW setpoint
Bridge Flow Switch
secondary
primary
45
Mar 10 2021 9:30:00 AM
Secondary CHW : 669.30
Primary CHW
Secondary CHW
500
Mar 9 2021
Mar 15 2021 9:30:00 AM
Secondary CHW : 312.90
Mar 16
2021

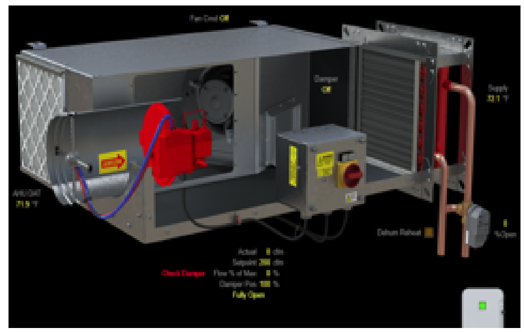
Project Cash Flow Summaries

Project - HFR BAS upgrade

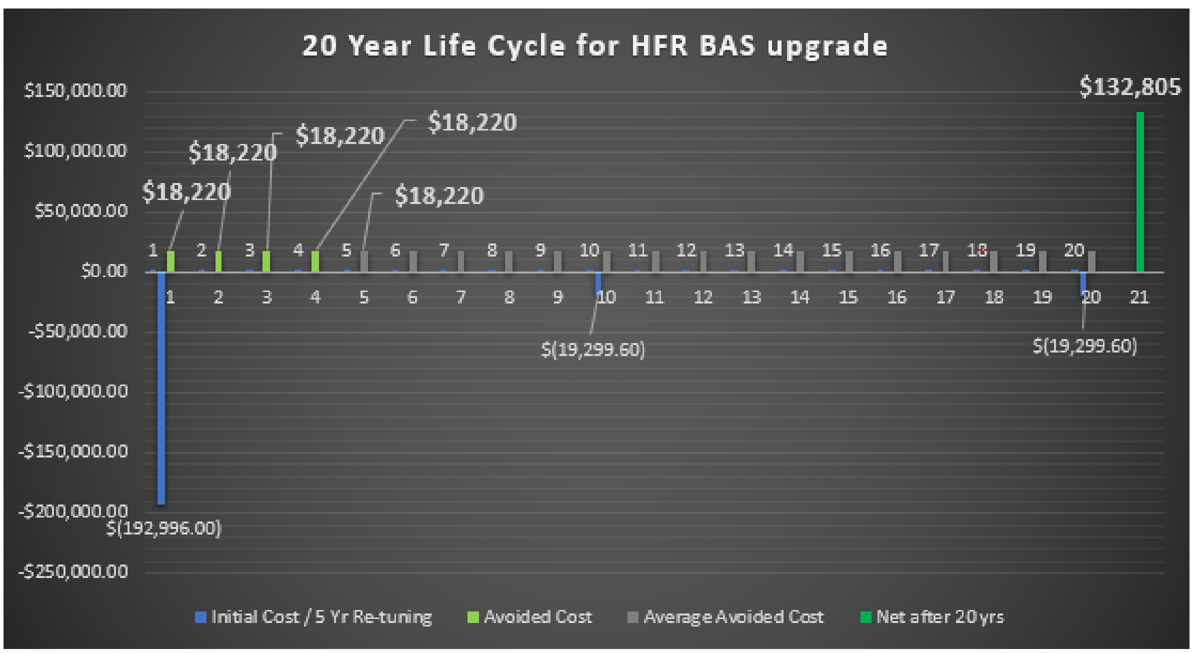
Initiated : 2/24/2020

Replaced existing 1990's building automation system at the HFR administration building. Reduced electrical usage by 30% ($15,523) and steam usage by 9% ($2,696), savings likely exaggerated by COVID, However, additional scheduling opportunities have been implemented that are not yet realized.

Initial Cost	$	192,996	
Annual Savings	$	18,220	
Savings to Date	$	18,220	*1 yr*
Simple payback		10.6	*yrs*
ROI		9.4%	
Net - 20 Year Life Cycle	$	132,805	



Typical fan coil at HFR



- *One year savings of $18,220 used to estimate 20 year cash flow*
- *10 % of initial cost used to estimate reoccuring replacement costs*

Project - Ramsey Arena - VFD & BAS installation

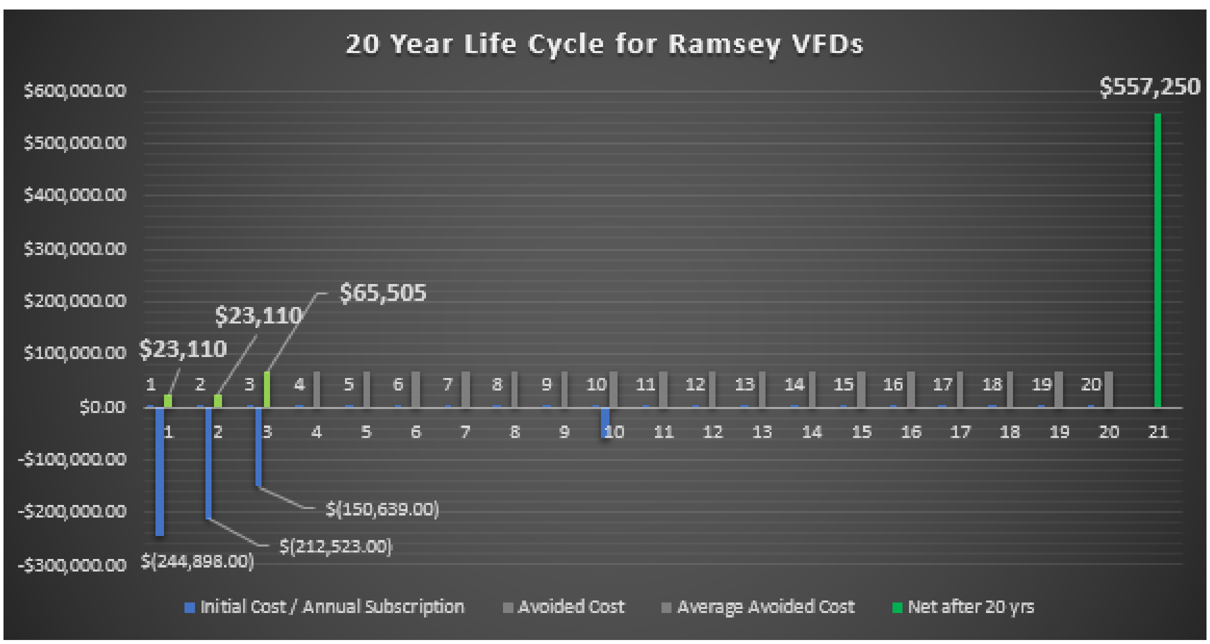
Initiated : May 2019

Variable Frequency Drives (VFDs) have been added to the 25 existing air handlers at Ramsey as part of a necessary controls upgrade. Reducing the speed on single zone air handlers from 60Hz to 40Hz not only saves energy, but reduces wear and tear on equipment.

Phase 1 of BAS controls upgrade ; savings achieved by manually lowering drive speeds on 12 single zone AHUs.

Phases 2 and 3 have involved replacing original controllers and valves on the Arena air handlers and adding control to the chiller and boiler plants

Cost to date	$ 608,060	
Annual Savings	$ 65,505	
Savings to Date	$ 111,725	*3 yrs.*
Simple payback	9.3	*yrs*
ROI	10.8%	
Net - 20 Year Life Cycle	$ 557,250	



- Year 10 - 10% replacement cost ($60,000) used to estimate 20 year cash flow

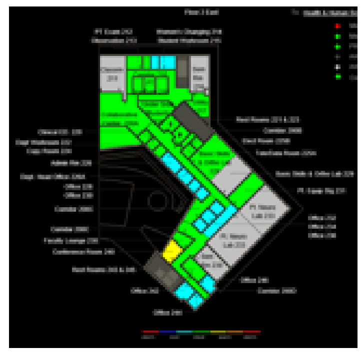
Project - Health and Human Science Building - Events2HVAC

Initiated : 10/9/2018
Updated 10/18/2019

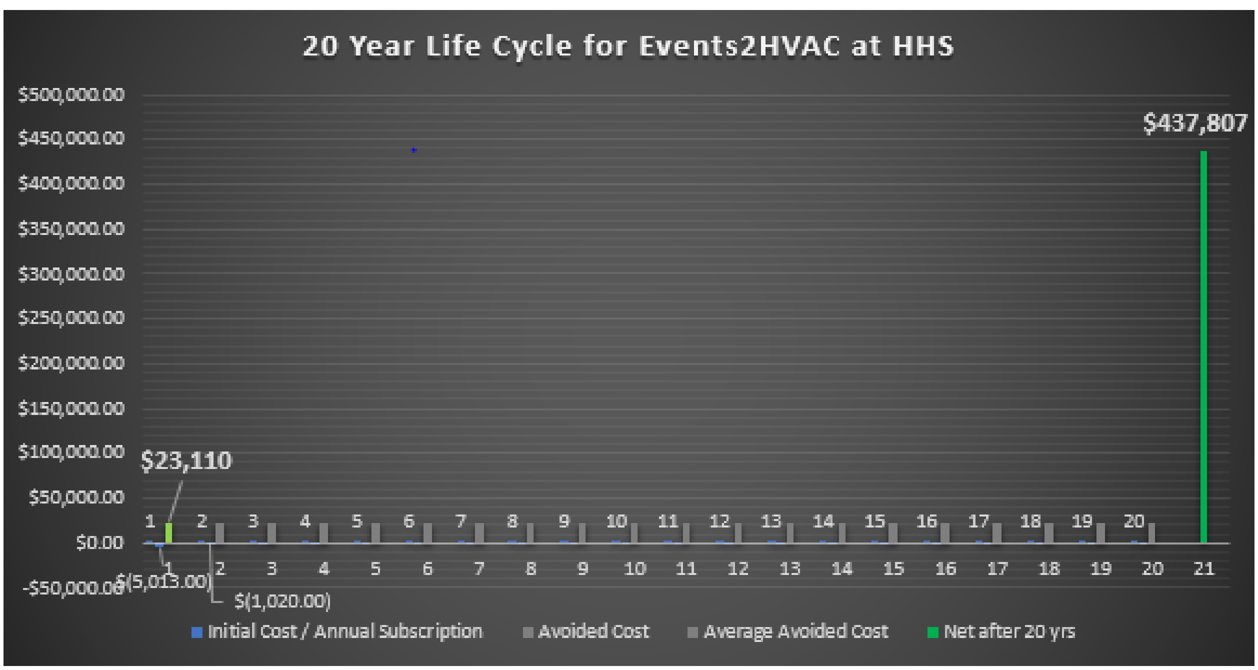
Events2HVAC was implemented in October of 2018 and has reduced energy usage 12% in the first 12 months. The Health and Human Science Building is now at ENERGY STAR level for an office building (25th percentile of energy usage compared to similar building stock) which is noteworthy considering it houses an anatomy lab, campus data servers, mutiple kitchen and fume hoods, and a PT clinic with hydrotherapy pool. Events2HVAC takes the classroom schedule from 25Live and pushes it out to the individual controllers at the building level. The result is that classrooms are heated/cooled based on actual class schedule (i.e. 8am-10am and 1pm-3pm) instead of a general schedule at the building level (7am-11pm).

Initial Cost	$ 5,013	
Annual Savings	$ 23,110	*$0.086/kWh*
Savings to Date	$ 23,110	
Simple payback	0.2	*yrs*
ROI	461.0%	
Net - 20 Year Life Cycle	$ 437,807	

The 268,719 kWh saved would require $400,000 in solar panels to generate the equivalent energy (200 kW system installed at $2,000 a kW)
PVWatts.com



Unoccupied areas in gray



- Year one savings ($23,110) used to estimate 20 year cash flow
- Annual subscription fee of $1,020

Project - Campus-wide upgrade to ultra-sonic meters

Initiated : October, 2015

Completion : 31 of 32 buildings

Previously, condensate from steam was captured using turbine meters that couldn't withstand the caustic environment of the condensate that is returned from the building back to the steam plant. Ultra-sonic meters reside on the exterior of the pipe, don't require additional flanges or bypass piping, and can be installed without a steam shutdown.

Initial Cost	$ 230,400	
Annual Savings	$ 118,182	*4 yr avg*
Savings to Date	$ 472,728	*4 yrs*
Simple payback	1.9	*yrs*
ROI	51.3%	
20 Year Life Cycle	$ 2,110,200	

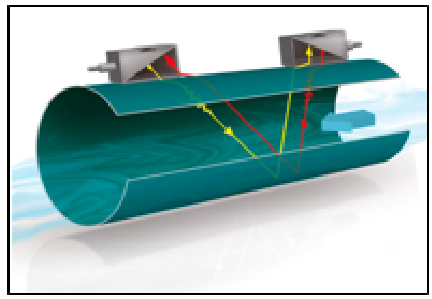
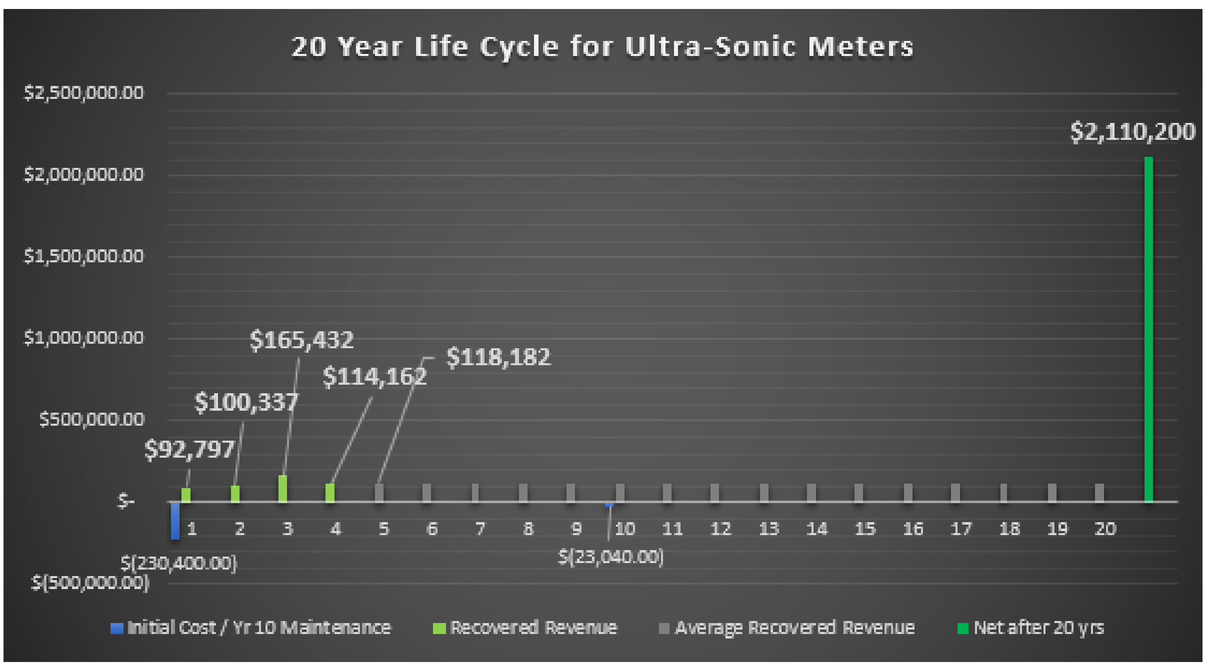


Image : Directindustry.com



- Four year average ($118,162) used to estimate 20 year cash flow

- 10 % of initial cost used to estimate Year 10 maintenance / replacement cost

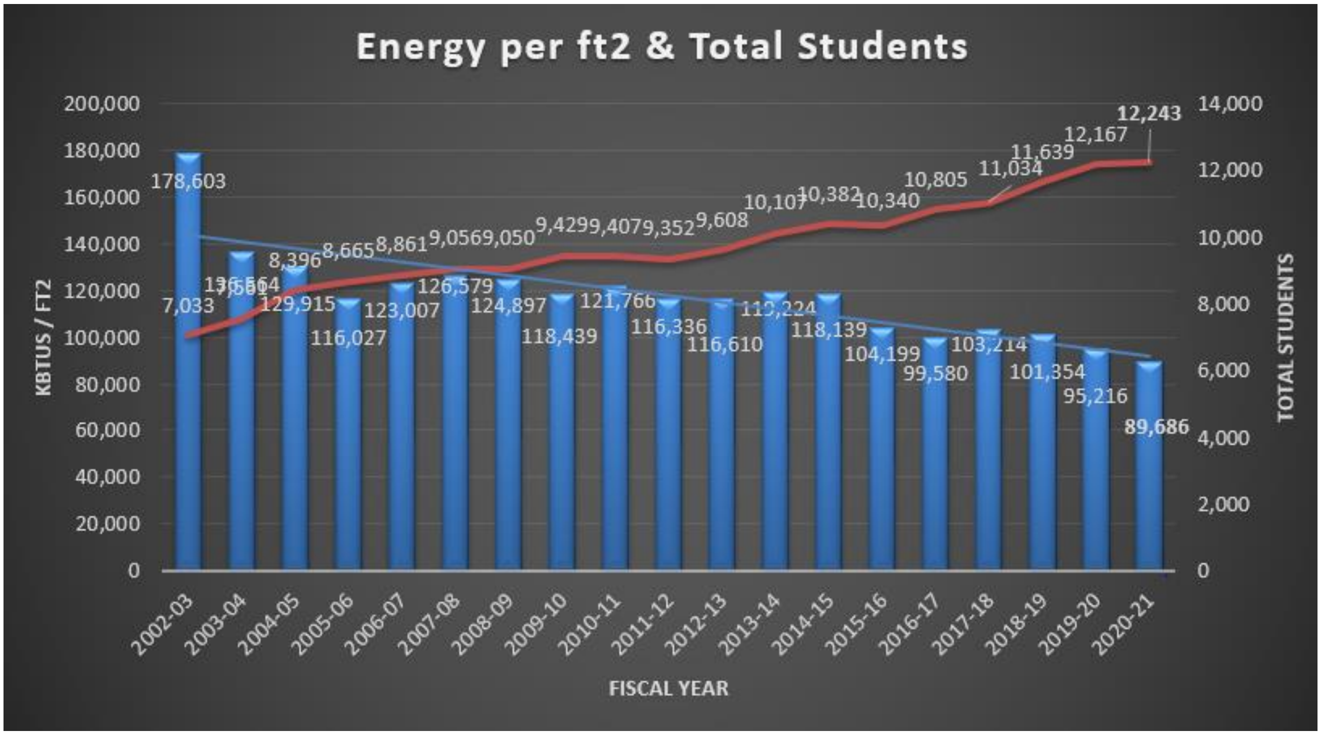
Addendum / Updated Data

1292 Carry Forward							
Project	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	Total to date
HFR renovation	$ 12,481	$ 12,673	$ 12,193	$ 12,193	$ 12,059	$ 12,155	$ 99,369
Make-up water savings	$ 15,118	$ 15,893	$ 10,297	$ 5,054	$ 5,380	$ 6,512	$ 69,520
Make-up water savings BTU savings	$ 25,806	$ 24,646	$ 14,949	$ 7,547	$ 8,223	$ 10,660	$ 115,403
HHS Savings	$ 10,786	$ 37,184	$ 41,533	$ 41,574	$ 57,991	$ 58,453	$ 247,520
Fine and Performing Arts		$ 12,640	$ 13,474	$ 10,494	$ 13,205	$ 13,510	$ 63,322
Belk AHU schedule			$ 3,710	$ 3,710	$ 3,710	$ 17,429.75	$ 28,560
Forsyth AHU programming			$ 6,233	$ 8,178	$ 8,878	$ 9,516	$ 32,806
Facilities Boiler replacement				$ 3,232	$ 3,112	$ 2,621	$ 8,965
Ramsey Arena VFD installation					$ 23,931	$ 24,122	$ 48,053
Ramsey Boiler/Chiller BAS						$ 41,383	$ 41,383
HFR BAS replacement						$ 18,293	$ 18,293
Stillwell AHU 3 BAS replacement						$ 6,066	$ 6,066
Hunter Library Chiller						$ 8,881	$ 8,881
	$ 64,191	**$ 103,036**	**$ 102,390**	**$ 91,982**	**$ 136,489**	**$ 229,602**	**$ 788,142**

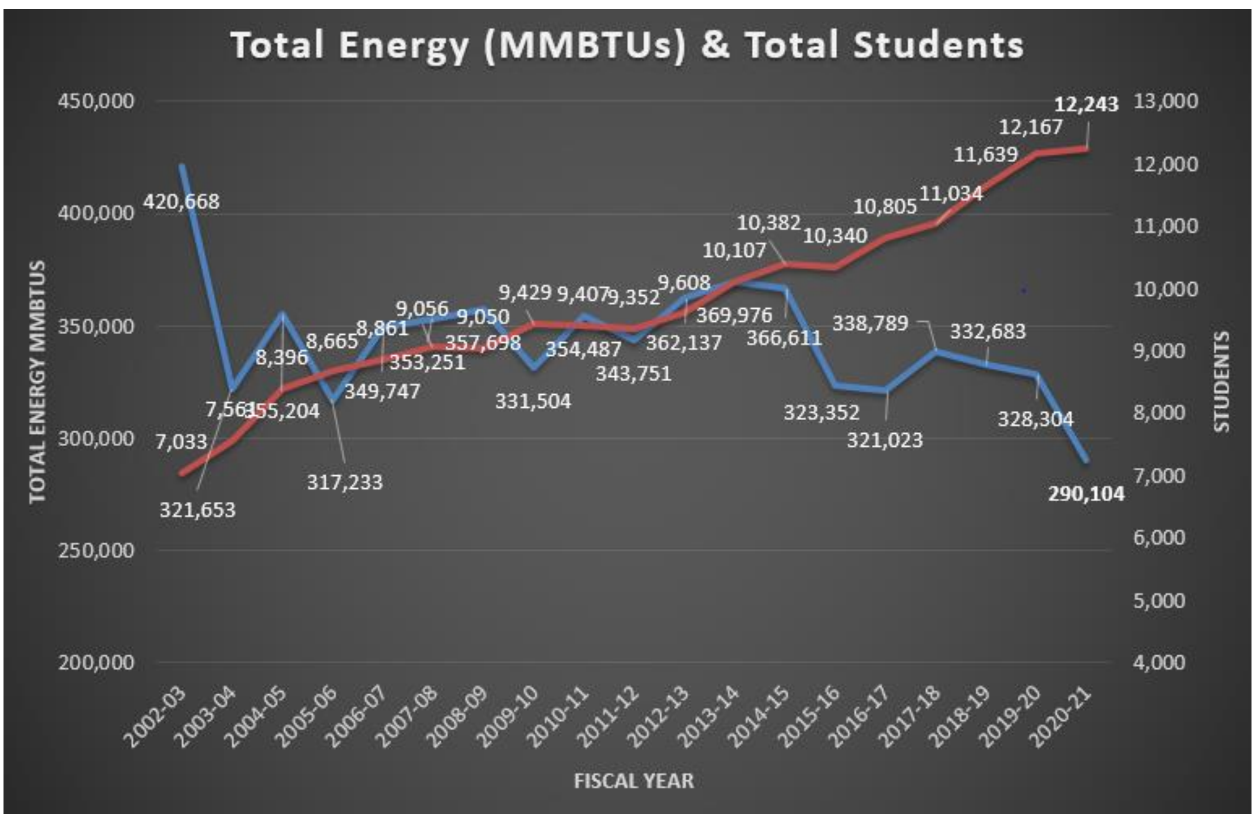
House Bill 1292 Energy Carry Forward Savings – additional projects have helped offset loss of previous condensate savings which were as high as $40,000 in FY16/17 down to $13,000 by FY19/20.

Recovered Steam Plant Operational Costs							
	FY15/16 (10 mont	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	Total to Date
Albright Benton	$ 16,978	$ 14,474	$ 15,752	$ 14,476	$ 22,051	$ 9,249	$ 92,981
Balsam	$ 7,659	$ 12,992	$ 15,306	$ 13,961	$ 28,845	$ 12,262	$ 91,025
Blue Ridge	$ 3,220	$ 1,244	$ 2,987	$ (1,240)	$ 1,843	$ 276	$ 8,331
Judaculla	$ 15,121	$ 19,248	$ 22,008	$ 20,616	$ 38,295	$ 11,562	$ 126,850
Courtyard	$ 37,841	$ 34,577	$ 50,434	$ 30,395	$ 30,452	$ 30,452	$ 214,151
Scott	$ (1,325)	$ (336)	$ (462)	$ (2,552)	$ (10,922)		$ (15,597)
Walker	$ 14,637	$ 15,453	$ 26,863	$ 18,170	$ 37,768		$ 112,890
University Center	$ (1,334)	$ (7,730)	$ 2,533	$ (7,401)	$ (13,279)	$ 1,466	$ (25,744)
Reynolds		$ 10,416	$ 20,736	$ 16,725	$ 20,661	$ 13,312	$ 81,849
Madison			$ 7,315	$ 9,668	$ 9,013	$ 10,860	$ 36,856
Robertson			$ 551	$ (3,796)	$ (7,482)		$ (10,727)
Bird			$ 1,409	$ 4,947	$ 5,318	$ 4,699	$ 16,372
Buchanan				$ 192			$ 192
	$ 92,797	**$ 100,337**	**$ 165,432**	**$ 114,162**	**$ 162,565**	**$ 94,137**	**$ 729,430**

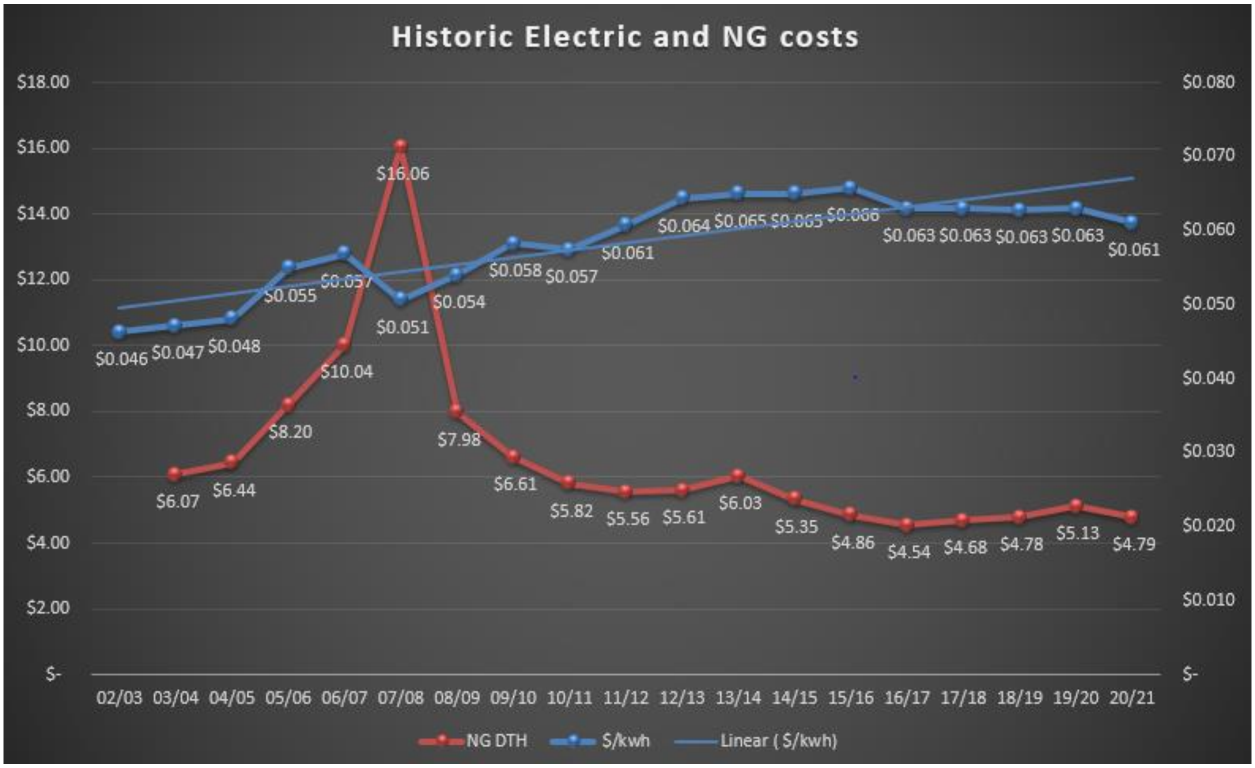
Recovered steam plant operational costs to date from campus wide meter upgrade



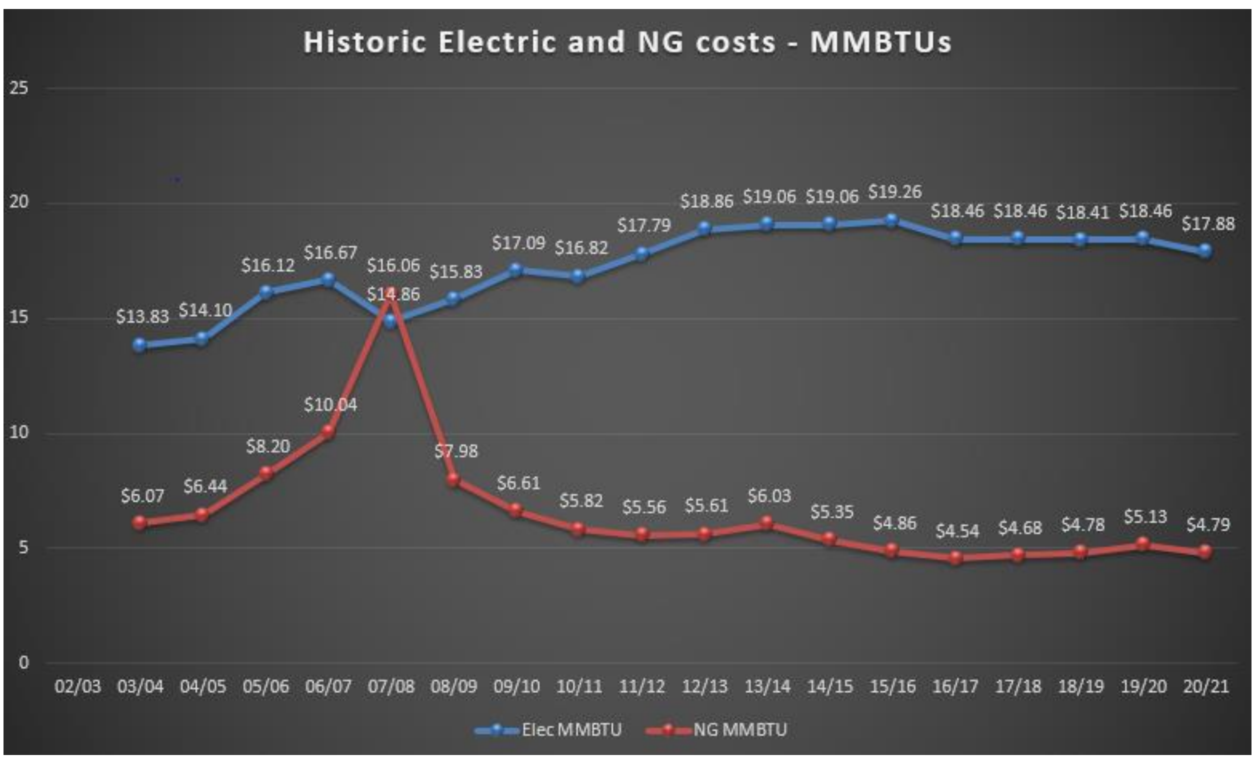
EUI and student growth compared to baseline FY 2002/2003; One BTU is equal to the energy in one match, WCU used the equivalent of 89,686 matches per square foot in F20/21.



More importantly total energy usage (MMBTUs = million BTUs) has also dropped over the last five years despite a 74% increase in students and 37% growth in campus square footage compared to baseline year of 2002/2003.



Electric cost per kWh and Natural Gas cost per Dekatherm (DTH)



Cost comparison for equal amount of energy (1,000,000 BTUs) ; electric almost 4x the cost to provide same amount of heat ; useful information for when projects want to use electric heating which typically has a lower initial cost

Building	Januar	Februar	March	Apri	May	June	Total	% of Total metered
Hunter Library	833,766	813,559	787,296	785,294	318,129	0	6,884,603	12.8%
Stillwell	915,140	748,482	656,133	545,036	254,320	0	6,577,708	12.2%
Coulter	391,897	381,889	427,183	372,556	144,074	0	3,805,742	7.1%
NSB	570,481	417,100	304,402	190,661	137,310	67	3,365,067	6.2%
FPAC	25,273	-41,850	0	0	0	0	3,198,978	5.9%
Belk	301,641	482,010	582,132	455,673	189,382	17,500	3,161,311	5.9%
Reynolds Hall	310,415	307,563	311,132	102,807	29,449	48,622	2,123,097	3.9%
Buchanan	279,238	268,593	252,191	139,536	36,385	39,976	2,087,690	3.9%
McKee Building	296,340	269,892	183,652	191,432	72,263	8,505	1,990,187	3.7%
Campus Rec Center	245,154	187,934	118,720	102,290	57,988	14,762	1,965,396	3.6%
Benton	172,438	306,670	305,794	155,316	26,313	0	1,907,708	3.5%
Balsam Residence	237,265	195,390	253,736	260,625	87,261	0	1,697,657	3.1%
Brown	274,319	240,042	248,607	124,248	76,704	86,903	1,623,648	3.0%
Central Drive	58,668	111,823	250,200	238,991	97,547	42,965	1,470,576	2.7%
Madison Hall	174,790	159,452	146,784	113,324	47,872	59,047	1,461,201	2.7%
Courtyard Dining	0	0	0	0	0	0	1,450,318	2.7%
Albright	174,239	193,588	179,418	110,313	23,102	0	1,306,244	2.4%
Blue Ridge Residence	160,211	129,529	167,375	159,928	45,169	0	1,214,746	2.3%
Forsyth Building	-276,796	196,023	138,669	116,468	40,666	0	1,066,061	2.0%
Old Student Union	98,495	108,670	87,153	89,655	67,387	59,965	1,054,009	2.0%
Killian	121,530	100,247	68,563	118,178	0	0	1,041,591	1.9%
HF Robinson Building	118,269	100,710	0	0	0	0	840,414	1.6%
Killian Annex	140,254	118,378	76,861	69,239	24,053	2,535	828,546	1.5%
Bird	104,067	93,546	76,661	55,503	19,909	0	683,618	1.3%
UC Hinds	0	33	129,770	128,303	33,927	3,153	653,789	1.2%
Robertson Hall	161,829	0	0	0	0	0	380,538	0.7%
CAT	21,444	19,253	12,662	3,140	1,213	0	113,471	0.2%
Reid Gym	0	0	0	0	0	0		
							53,953,914	

Steam usage (lbs.) for FY20/21; missing or incomplete data in red

In FY20/21, we measured 53,953,914 lbs. of steam at the building condensate meters compared to 81,594,488 lbs. produced at the steam plant. Considering that the steam charts at the plant over-estimate production and the building condensate meters won't capture what's flashed off or diverted down the drain when a condensate leak is identified, this represents 66.1% of production (lbs. at condensate meters / steam charts at plant)

If you use the steam plant production data, it results in a plant efficiency of 65% (BTUs in lbs. of steam produced / BTUs in natural gas consumed). Based on the steam condensate meters at the buildings you have a plant and system efficiency of 43% (BTUs based on gallons of steam condensate measured at building level / BTUs in natural gas consumed). Both numbers are down from the past year (75% to 65% at the steam plant and 56% to 43% at the building meters) due to condensate leaks that prevent heated water from returning to the steam plant.

The steam readings above in red represent either incomplete data or a condensate leak which shows zero as the steam condensate goes to the drain before the meter instead of continuing to leak under campus.

Row Labels	Sum of Steam	Steam cost	Sum of kWh	Electric Cost
Belk	5,745,847	$ 89,286	2,337,115	$ 147,939
Bird Building - Health Services	671,565	$ 10,958	272,174	$ 17,113
CAT	113,471	$ 1,796	402,559	$ 24,771
Forsyth Building	1,081,973	$ 16,145	1,130,274	$ 70,965
FPAC	7,018,445	$ 106,842	1,819,860	$ 112,597
HF Robinson Building	2,285,877	$ 34,976	648,900	$ 40,282
Killian	1,111,714	$ 17,054	664,900	$ 41,983
Killian Annex	893,631	$ 13,825	195,060	$ 11,965
McKee Building	2,145,950	$ 33,539	397,615	$ 24,535
Old Student Union		$ -	35,580	$ 2,227
Grand Total	**21,068,472**	**$ 324,421**	**5,568,722**	**$ 346,548**

Belk estimate based on 70% of $211,342, last total electric usage

1.559	lbs CO_2 / kWh
11.71	lbs CO_2 / CCF or 1 therm
22.4	lbs CO_2 / gallon of #2 oil
26	lbs CO_2 / gallon of #6 oil
12.7	lbs CO_2 / gallon of propane

Weekend setback 2 day (28% reduction and $0.033 per kWh weekends)

Building	Sum of Steam	Steam cost	Sum of kWh	Electric Cost	Lbs. of CO2 - steam	Lbs. of CO2 - electric
					CO_2 reduction	
Belk	1,641,671	25,510	667,747	22,036	381,596	1,041,018
Bird Building - Health Services	191,876	3,131	77,764	2,566	44,600	121,234
CAT	32,420	513	115,017	3,796	7,536	179,311
Forsyth Building	309,135	4,613	322,935	10,657	71,856	503,456
FPAC	2,005,270	30,526	519,960	17,159	466,112	810,618
HF Robinson Building	653,108	9,993	185,400	6,118	151,811	289,039
Killian	317,632	4,873	189,971	6,269	73,832	296,165
Killian Annex	255,323	3,950	55,731	1,839	59,348	86,885
McKee Building	613,128	9,582	113,604	3,749	142,518	177,109
Old Student Union	0	0	10,166	335	0	15,848
Grand Total	**6,019,563**	**$ 92,692**	**2,258,296**	**$ 74,524**	**1,399,208**	**3,520,684**
		$ 167,216	**Annual Savings**		**4,919,892**	**lbs. steam & electric**

Calculation of CO_2 savings with weekend setback for 10 office and academic buildings. Savings and reduction calcuations are rough estimates to demostrate potential savings and should not be taken as exact

WINSTON-SALEM STATE UNIVERSITY

Strategic Energy Plan

September 2021

EXECUTIVE SUMMARY

Existing Conditions/Background

Winston-Salem State University (WSSU) is a comprehensive, Historically Black University offering innovative undergraduate programs and exceptional graduate programs grounded in the tradition of liberal education. Since its founding in 1892, WSSU has grown from a one-room frame structure to more than forty-five buildings located on a picturesque 117-acre campus in the heart of Winston-Salem NC. Currently university buildings comprise approximately 2,000,000 gross square feet (GSF).
With a student-to-faculty ratio of 14:1 and a student body of more than 5,100, the university offers thirty-four baccalaureate degrees, seven master's degree programs, two professional doctorate programs and six certificate programs.

Control of utility costs and usage are one of the Goals of the WSSU Campus Strategic Plan. Stewardship of university resources and awareness of our environment is critical to successful operations at WSSU. The university will continue to collaborate with designers, contractors, and staff to improve energy efficiency of existing buildings through renovations. In the design and construction of new facilities the university will attempt to adhere to GS. 143-64.12 and continue to work towards the goals mandated within. To achieve the goal, replacement of HVAC systems, monitoring through the campus BAS, the change out of fluorescent lamps with LED bulbs or installation of thermostats with limited in room control are our objectives.

Energy Conservation Requirements

SB668 (GS 143-64.12) mandated that UNC System schools achieve a 30% reduction in BTUs/Sq. Ft by 2015 from a 2002-03 baseline year. While 30% goal was not an individual goal for each institution, the UNC System met the overall goal. To date, WSSU has achieved a 17% reduction from the 2002-03 baseline year as stated in the statute. Governor Cooper's Executive Order

80 released in October 2018 mandates a 40% reduction in BTUs/Sq. Ft for Cabinet Agencies only. Although Executive Order 80 does not specifically apply to the UNC system, it states that "North Carolina state owned facilities will strive to meet the goal by 2025. Currently, a bill has passed the house (HB330) that would incorporate the 40% goal of the Executive Order into GS 143-64.12 making it a statutory requirement for the UNC System if passed.

It is noted that the UNC System Policy Manual section 600.6.1 states: *The University of North Carolina ("The University") is committed to leading the State of North Carolina as an environmental steward that endeavors to proactively and effectively manage its impact on energy, water and other natural resources. Further, The University is obligated to ensure full compliance with all applicable local, state, and federal environmental laws and regulations. Therefore, it is the policy of The University's Board of Governors (the "Board") that The University, including General Administration, the constituent institutions, and affiliated entities, shall establish sustainable development and resource management, or "sustainability" as a core value of institutional operations, planning, capital construction, and purchasing practices.*

Energy and Water Consumption

During the 2020-21 fiscal year total utility expenditures amounted to approximately $2,650,000. During the same period WSSU purchased 27,380,489 kWh of electricity at a cost of $1,591,160; 1,2984,875 therms of natural gas at a cost of $637,643; and WSSU purchased 2,119 gallons of #2 fuel oil at a cost of $ 4,769. Water consumption for the university was in the amount of 43,844 gallons at a cost of $415,402. To date WSSU has achieved a 14% reduction in BTUs per square foot. Based on several factors including previously upgrading HVAC systems, taking two residence halls offline for renovations, and the COVID epidemic, may help explain some of the reduction in operations and expenditures for campus in the amount of over $131,000 in fiscal year 2020-2021.

Implementation

As the university struggles with COVID -19 and shortage of staffing Design & Construction will attempt to continue to develop procedures and processes that concentrate on energy use reduction, water conservation, and sustainability. It is the hope that as we are allowed to fill vacant positions that we can designate more individuals and time to energy use reduction and water conservation. Design & Construction will continue to educate students, faculty, and staff on simple measures that can yield reductions in energy usage and the university's carbon footprint. Reminding campus of turning off lights when spaces are not occupied, using bottle fill drinking fountains, and reminding the Facilities Management Team not to leave vehicles idling, are measures that will assist with the reduction of our carbon footprint. Upon filling vacant positions, D&C will make a concerted effort to continue to work with the State Energy Office to explore ways to enhance energy conservation on campus and to stay abreast of best practices.

WSSU will maximize opportunities to derive benefits from the 2010 Guaranteed Energy Savings Performance Contract (PC) with Siemens. Staff will work with Siemens, to ensure that the maximum energy is conserved that is planned to provide costs avoidance. In conjunction with Siemens Performance Contract, D&C will collaborate with designers and vendors to correct any equipment that may need attention to function properly because of the time that has passed since the equipment has been installed.

KEY PERFORMANCE INDICATORS

		energy evaluation						water/sewer evaluation				
		energy $ avoided	energy $/gsf	$/mmbtu	$/mmbtu %change	btu/sf	btu/sf %change	water $ avoided	$/kgal	$/kgal %change	gal/sf	gal/sf %change
2017-18	Winston Salem State University	$516,697	$1.36	$12.74	26%	106,567	-17%	$841,308	$9.28	294%	32.04	-60%
2018-19	Winston Salem State University	$483,977	$1.30	$12.04	19%	107,560	-16%	$948,783	$9.16	289%	27.13	-66%
2019-20	Winston Salem State University	$474,883	$1.17	$10.97	8%	106,990	-17%	$929,613	$8.22	249%	24.94	-69%
2020-21	Winston Salem State University	$355,066	$1.11	$9.99	-1%	110,837	-14%	$1,132,301	$9.47	302%	21.73	-73%

FOCUS AREAS

Focus Area 1 - Energy Data Management

2021-2022 Planned Activity

The university will continue to update its established Excel spreadsheets for collecting and analyzing monthly energy billing information. This effort is designed to enhance the evaluation of energy usage variations and to assist in determining the corrective action required.

Responsible: Administrative Assistant, Project Managers
Funding Source: Salary
Metric: All necessary data recorded and reviewed

2021-2022 Planned Activity

Investigate and have BAS updated for campus buildings.

Responsible: Project Manager
Funding Source: Salary
Metric: Ensure that all building that are on the BAS can be controlled remotely.

Focus Area 2 – Outreach, Training, Communication

2021-2022 Planned Activity

Present the WSSU Strategic Energy Plan and energy usage to university Leadership.

Responsible: Project Manager, State Energy Office, and Assistant Vice Chancellor
Funding Source: Salary
Metric: Presentation occurs

2021-2022 Planned Activity
Attend NC State University Energy Management Training Series

Responsible: Project Managers
Funding Source: Salary, State Energy Office (class & materials fees); WSSU (travel, lodging, and meals)
Metric: Passing the class

2021-2022 Planned Activity
Seek out opportunities for staff training by vendors

Responsible: Project Manager, Vendors
Funding Source: No cost
Metric: Presentations occurs

Focus Area 3 - Facility and Resiliency Projects

2021-2022 Planned Activity
Continue to repair and replace steam and condensate lines throughout campus.

Responsible: Project Manager, Contractor
Funding Source: Repairs and Renovations Funds
Metric: Steam pipes and condensate lines repaired or replaced

2020-2021 Planned Activity
Continue to change existing exterior lights to energy efficient LED lamps

Responsible: Maintenance Department
Funding Source: Repairs and Renovation Funds
Metric: Change outs occur

APPENDIX 1

2020-2021 PLANNED ACTIVITY COMPLETION

Focus Area 1 - Energy Data Management Activity Completion

2020-2021 Planned Activity
The University will continue to update its established Excel spreadsheets for collecting and analyzing monthly energy billing information. This effort is designed to enhance the evaluation of energy usage variations and to assist in determining the corrective action required.
Results
Monthly energy information was collected, recorded in the Excel spreadsheet, and analyzed.

2020-2021 Planned Activity
Devise and implement low one cost project to reduce energy consumption in the largest gas consuming building, and one project to reduce energy consumption in the largest power consuming buildings on campus.

Results
Due to COIVD-19 and being short staffed this Planned Activity was not implemented.

Focus Area 2 – Outreach, Training, Communication Activity Completion

2020-2021 Planned Activity
Identify an opportunity to communicate the Strategic Plan and energy usage to university Leadership with the help of the State Energy Office.
Results
Due to COIVD-19 and being short staffed this Planned Activity was not implemented.

2020-2021 Planned Activity

Goal 4 of the 2016-2021 Winston Salem State University Strategic Plan is to "Enhance Revenue and Stewardship of Resources". Objective 4.1 within Goal 4 states "All plans policies and reward structures will reflect a commitment to stewardship of resources". One strategy of Objective 4.1 is to increase resource and energy sustainability. WSSU will move to incorporate this Strategic Energy Plan into the university Strategic Plan to further the importance of work already being done to conserve energy and water across campus.

Results

Due to COIVD-19 and being short staffed this Planned Activity was not implemented.

2019-2020 Planned Activity

Attend NC State University Energy Management Training Series.

Results

Due to COIVD-19 Planned Activity was not implemented.

2019-2020 Planned Activity

Seek out opportunities for staff training by vendors.

Results

Facilities staff attended the following project specific energy related training opportunities:
Facilities Operations staff shadowed TRS a vendor, while repairs were being made to the Central Chiller Plant.
Training was provided for the new BAS at FL at the New Sciences Building by Siemens

2020-2021 Planned Activity

Establish and fill student internship opportunities within the WSSU energy program.

Results Due to COIVD-19 and being short staffed this Planned Activity was not implemented.

Focus Area 3 - Facility and Resiliency Projects Activity Completion

2020-2021 Planned Activity

Repair steam and condensate lines at Elva Jones, FL Atkins, and KR Williams buildings

Results Steam and condensate lines at Elva Jones, FL Atkins, and KR Williams buildings were replaced.

2020-2021 Planned Activity

Change existing exterior lights to energy efficient LED lamps.

Results Due being short staffed and this Planned Activity was not implemented

Focus Area 4 – Water Conservation Activity Completion

2020-2021 Planned Activity
Identify water leaks through observation and monitoring of water bill irregularities
Results Due being short staffed and this Planned Activity was not implemented.

Mandate for Energy Management

WSSU has not met the statuary goal of a 30% reduction of BTUs per square foot from the baseline fiscal year 2002-03 through 2015. Executive Order 80 requires a 40% reduction by 2025 for state owned buildings. In addition, the UNC System has a goal to be carbon neutral by 2050.

Energy and energy management must be recognized as a controllable operating expense wherein savings can result in funding being available for other program needs. If the energy management program is to be successful, all members of the Winston-Salem State University Community, Students, Faculty, and Staff, have important roles to play. Energy cost reduction must become a vital part of the University Strategic Energy Plan. WSSU will endeavor to achieve 104,000 BTUs per square foot by fiscal year 2020- 2021 from 2019-2020 baseline.

The attached plan outlines the activities required to reduce energy and water consumption to achieve the goals of the programs.

____
Assistant VC Facilities

__________________________________ __________________________________
VC Finance and Administration Chancellor

Appendix D

Executive Order No. 80

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State of North Carolina

ROY COOPER

GOVERNOR

October 29, 2018

EXECUTIVE ORDER NO. 80

NORTH CAROLINA'S COMMITMENT TO ADDRESS CLIMATE CHANGE AND TRANSITION TO A CLEAN ENERGY ECONOMY

WHEREAS, North Carolina residents deserve to be better educated, healthier, and more financially secure so that they may live purposeful and abundant lives; and

WHEREAS, N.C. Const. art. XIV, § 5 requires the conservation, protection, and preservation of state lands and waters in public trust; and

WHEREAS, North Carolina is well positioned to take advantage of its technology and research and development sectors, along with its skilled workforce, to promote clean energy technology solutions and a modernized electric grid; and

WHEREAS, public-private partnerships in North Carolina foster market innovations and develop clean energy technology solutions that grow the state's economy; and

WHEREAS, the effects of more frequent and intense hurricanes, flooding, extreme temperatures, droughts, saltwater intrusion, and beach erosion have already impacted and will continue to impact North Carolina's economy; and

WHEREAS, climate-related environmental disruptions pose significant health risks to North Carolinians, including waterborne disease outbreaks, compromised drinking water, increases in disease-spreading organisms, and exposure to air pollution, among other issues; and

WHEREAS, to maintain economic growth and development and to provide responsible environmental stewardship, we must build resilient communities and develop strategies to mitigate and prepare for climate-related impacts in North Carolina.

NOW, THEREFORE, by the authority vested in me as Governor by the Constitution and the laws of the State of North Carolina, **IT IS ORDERED**:

1. The State of North Carolina will support the 2015 Paris Agreement goals and honor the state's commitments to the United States Climate Alliance.

   The State of North Carolina will strive to accomplish the following by 2025:

   a. Reduce statewide greenhouse gas emissions to 40% below 2005 levels;
   b. Increase the number of registered, zero-emission vehicles ("ZEVs"; individually, "ZEV") to at least 80,000;
   c. Reduce energy consumption per square foot in state-owned buildings by at least 40% from fiscal year 2002-2003 levels.

2. Cabinet agencies shall evaluate the impacts of climate change on their programs and operations and integrate climate change mitigation and adaptation practices into their programs and operations. Council of State members, higher education institutions, local governments, private businesses, and other North Carolina entities are encouraged to address climate change and provide input on climate change mitigation and adaptation measures developed through the implementation of this Executive Order. Consistent with applicable law, cabinet agencies shall actively support such actions.

3. The Secretary or designee of each cabinet agency and a representative from the Governor's Office shall serve on the North Carolina Climate Change Interagency Council ("Council"), which is hereby established. The Secretary of the North Carolina Department of Environmental Quality, or the Secretary's designee, shall serve as the Council Chair. The North Carolina Department of Environmental Quality shall lead the Council by providing strategic direction, scheduling and planning Council meetings, determining the prioritization of activities, facilitating stakeholder engagement, and assisting in the implementation of pathways to achieve the goals provided in Section 1 of this Executive Order.

   The duties of the Council shall include the following:

   a. Recommend new and updated goals and actions to meaningfully address climate change;
   b. Develop, implement, and evaluate programs and activities that support statewide climate mitigation and adaptation practices;
   c. Establish workgroups, as appropriate, to assist the Council in its duties;
   d. Consider stakeholder input when developing recommendations, programs, and other actions and activities;
   e. Schedule, monitor, and provide input on the preparation and development of the plans and assessments required by this Executive Order;
   f. Review and submit to the Governor the plans and assessments required by this Executive Order.

4. The North Carolina Department of Environmental Quality ("DEQ") shall develop a North Carolina Clean Energy Plan ("Clean Energy Plan") that fosters and encourages the utilization of clean energy resources, including energy efficiency, solar, wind, energy storage, and other innovative technologies in the public and private sectors, and the integration of those resources to facilitate the development of a modern and resilient electric grid. DEQ shall collaborate with businesses, industries, power providers, technology developers, North Carolina residents, local governments, and other interested stakeholders to increase the utilization of clean energy technologies, energy efficiency measures, and clean transportation solutions. DEQ shall complete the Clean Energy Plan for the Council to submit to the Governor by October 1, 2019.

5. The North Carolina Department of Transportation ("DOT"), in coordination with DEQ, shall develop a North Carolina ZEV Plan ("ZEV Plan") designed to increase the number of registered ZEVs in the state to at least 80,000 by 2025. The ZEV Plan shall help establish interstate and intrastate ZEV corridors, coordinate and increase the installation of ZEV infrastructure, and incorporate, where appropriate, additional best practices for increasing ZEV adoption. DOT shall complete the ZEV Plan for the Council to submit to the Governor by October 1, 2019.

6. The North Carolina Department of Commerce ("DOC") and other cabinet agencies shall take actions supporting the expansion of clean energy businesses and service providers, clean technology investment, and companies with a commitment to procuring renewable energy. In addition, DOC shall develop clean energy and clean transportation workforce assessments for the Council to submit to the Governor by October 1, 2019. These assessments shall evaluate the current and projected workforce demands in North Carolina's clean energy and clean transportation sectors, assess the skills and education required for employment in those sectors, and recommend actions to help North Carolinians develop such skills and education.

7. Cabinet agencies shall prioritize ZEVs in the purchase or lease of new vehicles and shall use ZEVs for agency business travel when feasible. When ZEV use is not feasible, cabinet agencies shall prioritize cost-effective, low-emission alternatives. To support implementation of this directive, the North Carolina Department of Administration ("DOA") shall develop a North

Carolina Motor Fleet ZEV Plan ("Motor Fleet ZEV Plan") that identifies the types of trips for which a ZEV is feasible, recommends infrastructure necessary to support ZEV use, develops procurement options and strategies to increase the purchase and utilization of ZEVs, and addresses other key topics. DOA shall complete the Motor Fleet ZEV Plan and provide an accounting of each agency's ZEVs and miles driven by vehicle type for the Council to submit to the Governor by October 1, 2019, and annually thereafter.

8. Building on the energy, water, and utility use conservation measures taken pursuant to N.C. Gen. Stat. § 143-64.12(a), DEQ shall update and amend, where applicable, a Comprehensive Energy, Water, and Utility Use Conservation Program ("Comprehensive Program") by February 1, 2019, and biennially beginning December 1, 2019, to further reduce energy consumption per gross square foot in state buildings consistent with Section 1 of this Executive Order. The Comprehensive Program shall include best practices for state government building energy efficiency, training for agency staff, cost estimation methodologies, financing options, and reporting requirements for cabinet agencies. DEQ and cabinet agencies shall encourage and assist, as requested, higher education institutions, K-12 schools, and local governments in reducing energy consumption. To achieve the required energy consumption reductions:

    a. By January 15, 2019, each cabinet agency shall designate an Agency Energy Manager, who shall serve as the agency point of contact.
    b. Each cabinet agency shall develop and submit an Agency Utility Management Plan to DEQ by March 1, 2019, and biennially thereafter, and implement strategies to support the energy consumption reduction goal set forth in Section 1 of this Executive Order. DEQ shall assess the adequacy of these plans and their compliance with this Executive Order.
    c. By September 1, 2019, and annually thereafter, each cabinet agency shall submit to DEQ an Agency Utility Report detailing its utility consumption, utility costs, and progress in reducing energy consumption.
    d. DEQ shall develop an annual report that describes the Comprehensive Program and summarizes each cabinet agency's utility consumption, utility costs, and achieved reductions in energy consumption. DEQ shall complete this report for publication on its website and for the Council to submit to the Governor by February 1, 2019, and annually thereafter beginning December 1, 2019.

9. Cabinet agencies shall integrate climate adaptation and resiliency planning into their policies, programs, and operations (i) to support communities and sectors of the economy that are vulnerable to the effects of climate change and (ii) to enhance the agencies' ability to protect human life and health, property, natural and built infrastructure, cultural resources, and other public and private assets of value to North Carolinians.

    a. DEQ, with the support of cabinet agencies and informed by stakeholder engagement, shall prepare a North Carolina Climate Risk Assessment and Resiliency Plan for the Council to submit to the Governor by March 1, 2020.
    b. The Council shall support communities that are interested in assessing risks and vulnerabilities to natural and built infrastructure and in developing community-level adaptation and resiliency plans.

10. DEQ shall prepare and manage a publicly accessible Web-based portal detailing the Council's actions and the steps taken to address climate-related impacts in North Carolina. Cabinet agencies shall submit data, information, and status reports as specified by the Council to be published on the portal. In addition, DEQ shall develop, publish on the portal, and periodically update an inventory of the state's greenhouse gas emissions that, among other things, tracks emissions trends statewide by sector and identifies opportunities for additional emissions reductions.

11. By October 15, 2019, and annually thereafter, the Council shall provide to the Governor a status report on the implementation of this Executive Order.

12. This Executive Order is consistent with and does not otherwise abrogate existing state law.

13. This Order is effective October 29, 2018 and shall remain in effect until rescinded or superseded by another applicable Executive Order.

IN WITNESS WHEREOF, I have hereunto signed my name and affixed the Great Seal of the State of North Carolina at the Capitol in the City of Raleigh, this the 29th day of October, in the year of our Lord two thousand eighteen.

Roy Cooper
Governor

ATTEST:

Rodney S. Maddox
Chief Deputy Secretary of State

Appendix E

General Statute Chapter 143-64.12, *Authority and Duties of the Department; State Agencies and State Institutions of Higher Learning*

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§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by 2010 and thirty percent (30%) by 2015 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially and include strategies for supporting the energy consumption reduction requirements under this subsection. Each community college shall submit to the State Energy Office a biennial written report of utility consumption and costs. Management plans submitted biennially by State institutions of higher learning shall include all of the following:

(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.

(2) The cost of analyzing the projected energy savings.

(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.

(4) An analysis that identifies projected annual energy savings and estimated payback periods.

(a1) State agencies and State institutions of higher learning shall carry out the construction and renovation of facilities in such a manner as to further the policy set forth under this section and to ensure the use of life-cycle cost analyses and practices to conserve energy, water, and other utilities.

(b) The Department of Administration shall develop and implement policies, procedures, and standards to ensure that State purchasing practices improve efficiency regarding energy, water, and other utility use and take the cost of the product over the economic life of the product into consideration. The Department of Administration shall adopt and implement Building Energy Design Guidelines. These guidelines shall include energy-use goals and standards, economic assumptions for life-cycle cost analysis, and other criteria on building systems and technologies. The Department of Administration shall modify the design criteria for construction and renovation of facilities of State buildings and State institutions of higher learning buildings to require that a life-cycle cost analysis be conducted pursuant to G.S. 143-64.15.

(b1) The Department of Administration, as part of the Facilities Condition and Assessment Program, shall identify and recommend energy conservation maintenance and operating procedures that are designed to reduce energy consumption within the facility of a State agency or a State institution of higher learning and that require no significant expenditure of funds. Every State agency or State institution of higher learning shall implement these recommendations. Where energy management equipment is proposed for any facility of a State agency or of a State institution of higher learning, the maximum interchangeability and compatibility of equipment components shall be required. As part of the Facilities Condition and Assessment Program under this section, the Department of Administration, in consultation with the State Energy Office, shall develop an energy audit and a procedure for conducting energy audits. Every five years the Department shall conduct an energy audit for each State agency or State institution of higher learning, and the energy audits conducted shall serve as a preliminary energy survey. The State Energy Office shall be responsible for system-level detailed surveys.

(b2) The Department of Administration shall submit a report of the energy audit required by subsection (b1) of this section to the affected State agency or State institution of higher learning and to the State Energy Office. The State Energy Office shall review each audit and, in consultation with the affected State agency or State institution of higher learning, incorporate the audit findings and recommendations into the management plan required by subsection (a) of this section.

(c) through (g) Repealed by Session Laws 1993, c. 334, s. 4.

(h) When conducting a facilities condition and assessment under this section, the Department of Administration shall identify and recommend to the State Energy Office any facility of a State agency or State institution of higher learning as suitable for building commissioning to reduce energy consumption within the facility or as suitable for installing an energy savings measure pursuant to a guaranteed energy savings contract under Part 2 of this Article.

(i) Consistent with G.S. 150B-2(8a)h., the Department of Administration may adopt architectural and engineering standards to implement this section.

(j) The State Energy Office shall submit a report by December 1 of every odd-numbered year to the Joint Legislative Energy Policy Commission, the Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, and the Fiscal Research Division describing the comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning required by subsection (a) of this section. The report shall also contain the following:

(1) A comprehensive overview of how State agencies and State institutions of higher learning are managing energy, water, and other utility use and achieving efficiency gains.

(2) Any new measures that could be taken by State agencies and State institutions of higher learning to achieve greater efficiency gains, including any changes in general law that might be needed.

(3) A summary of the State agency and State institutions of higher learning management plans required by subsection (a) of this section and the energy audits required by subsection (b1) of this section.

(4) A list of the State agencies and State institutions of higher learning that did and did not submit management plans required by subsection (a) of this section and a list of the State agencies and State institutions of higher learning that received an energy audit.

(5) Any recommendations on how management plans can be better managed and implemented. (1975, c. 434, s. 3; 1993, c. 334, s. 4; 2000-140, s. 76(f); 2001-415, s. 3; 2006-190, s. 12; 2007-546, s. 3.1(a); 2008-198, s. 11.1; 2009-446, s. 1(e); 2010-31, s. 14.3; 2010-196, s. 2; 2013-360, s. 15.22(p); 2014-120, s. 55; 2015-241, s. 14.30(u); 2017-57, s. 14.1(f).)

Appendix F

Suggested Revisions to General Law

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PART I. SAVE NORTH CAROLINA TAXPAYER DOLLARS BY REQUIRING REDUCTIONS IN ENERGY AND WATER CONSUMPTION IN PUBLIC BUILDINGS BY 2025.

Section 1. G.S. 143-64.12(a) reads as rewritten:

"§ 143-64.12. Authority and duties of the Department; State agencies and State institutions of higher learning.

(a) The Department of Environmental Quality through the State Energy Office shall develop a comprehensive program to manage energy, water, and other utility use for State agencies and State institutions of higher learning and shall update this program annually. Each State agency and State institution of higher learning shall develop and implement a management plan that is consistent with the State's comprehensive program under this subsection to manage energy, water, and other utility use, and that addresses any findings or recommendations resulting from the energy audit required by subsection (b1) of this section. The energy consumption per gross square foot for all State buildings in total shall be reduced by twenty percent (20%) by ~~2010~~ 2010, and thirty percent (30%) by ~~2015~~ 2015, and forty percent (40%) by 2025 based on energy consumption for the 2002-2003 fiscal year. Each State agency and State institution of higher learning shall update its management plan biennially by March 1st of odd-numbered years and include strategies for supporting the energy consumption reduction requirements under this subsection. Each State agency, State institution of higher learning, and community college shall submit to the State Energy Office ~~a biennial~~ an annual written report of utility consumption and ~~costs.~~ costs by September 1st. Management plans submitted biennially by State agencies and State institutions of higher learning shall ~~include all of the following:~~ contain:

~~(1) Estimates of all costs associated with implementing energy conservation measures, including pre-installation and post-installation costs.~~

~~(2) The cost of analyzing the projected energy savings.~~

~~(3) Design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source.~~

~~(4) An analysis that identifies projected annual energy savings and estimated payback periods.~~

(1) Total utility consumption, costs, and efficiency gains.

(2) Findings or recommendations resulting from an energy audit to determine potential energy conservation measures.

(3) An analysis of energy conservation measures that may be implemented to reduce energy, water, and other utility use, including but not limited to:

- a. Total design costs, engineering costs, pre-installation costs, post-installation costs, debt service, and any costs for converting to an alternative energy source;
- b. Projected annual energy savings and estimated payback periods;
- c. Finance options; and
- d. Defined roles, responsibilities, and training needs for staff that manage energy, water, or other utility use.

(4) A signature from senior leadership, or an appropriate designee, of a State agency or State institution of higher learning.

PART II. EFFECTIVE DATE

Section 2. Except as otherwise provided, Section 1 of this act is effective when it becomes law.

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